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(54) **METHOD AND APPARATUS FOR AUTOMATIC CALL TEST IN A CDMA SYSTEM**

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(52) **U.S. Cl.** **370/252**; 370/242; 370/320; 370/335; 370/342; 455/67.1; 455/423; 714/25

(58) **Field of Search** 370/252, 241, 370/241.1, 242, 243, 244, 245, 320, 335, 342; 455/67.1, 67.3, 67.4, 67.6, 67.7, 423, 424, 425, 426; 714/25, 799

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(57) **ABSTRACT**

A method automatically measures parameter data relating to wireless network environment in a code division multiple access(CDMA) system. First, if a server's telephone number is detected from power-on registration data stored in a storage device, then a connection with the server is attempted through a mobile station with a data service function using the server's telephone number. Thereafter, if there is test plan program data from the server after the connection is made, the parameter data is measured using another mobile station with a diagnostic monitor function based on the test plan program data. The measured parameter data is then collected and parsed to obtain sets of measured parameter data, each set having a different kind of measured data; and, finally, the sets of measured parameter data are transmitted to the server using the mobile station with the data service function when there is a data transmission request from the server.

20 Claims, 4 Drawing Sheets

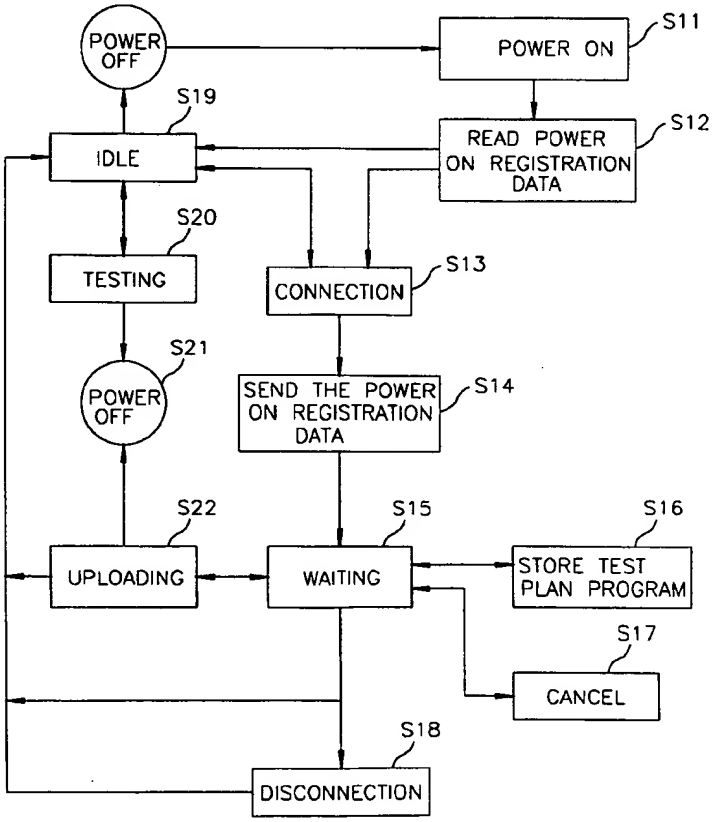


FIG. 1

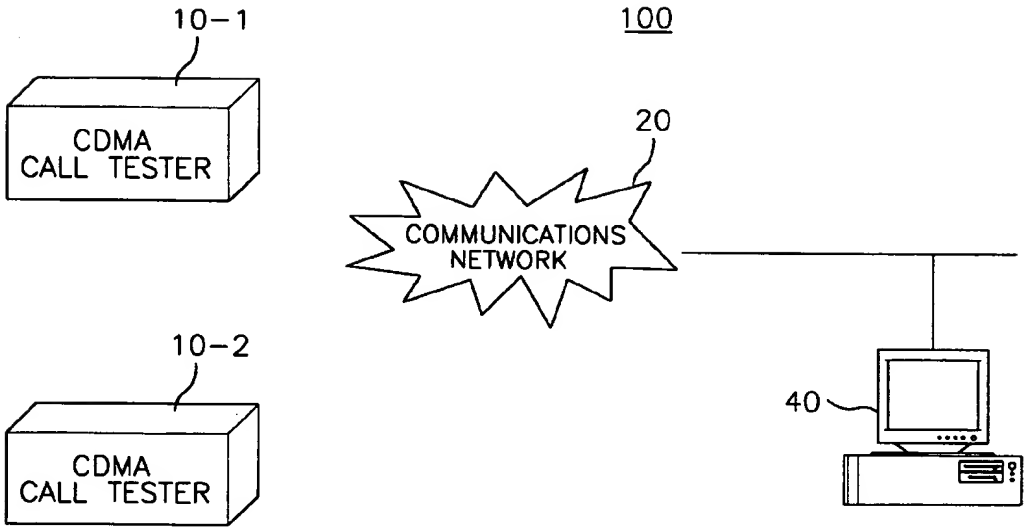

10-1
CDMA CALL TESTER
100
20
COMMUNICATIONS NETWORK
10-2
CDMA CALL TESTER
40

FIG. 2

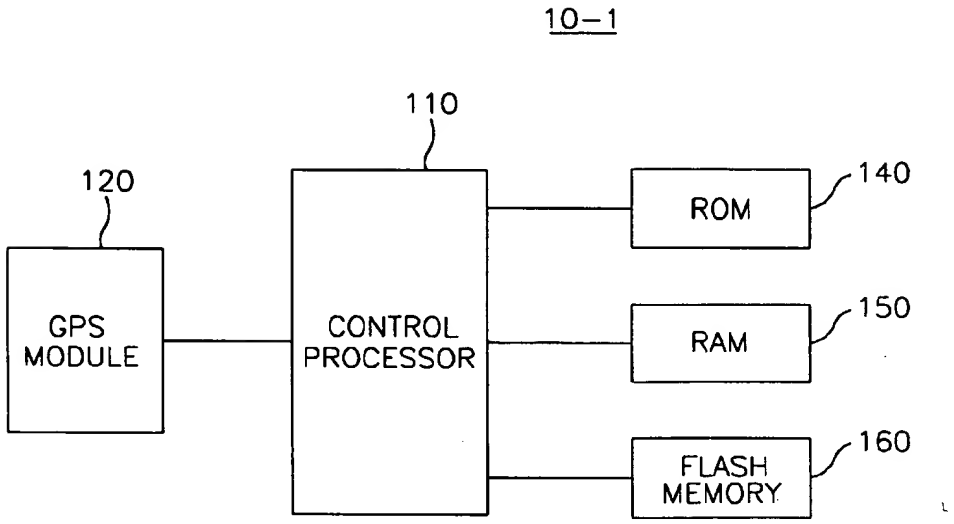

10-1
110
120
GPS MODULE
CONTROL PROCESSOR
ROM
140
RAM
150
FLASH MEMORY
160

FIG.3

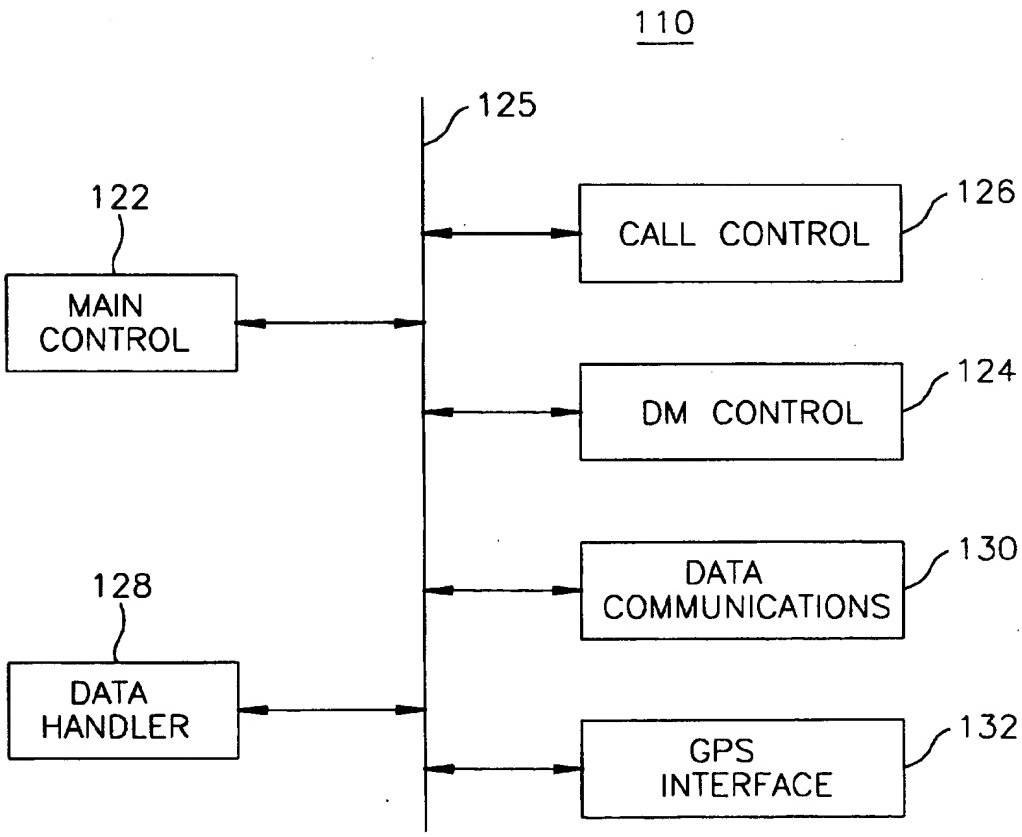

110
125
122
MAIN CONTROL
CALL CONTROL
126
DM CONTROL
124
128
DATA HANDLER
DATA COMMUNICATIONS
130
GPS INTERFACE
132

FIG. 4

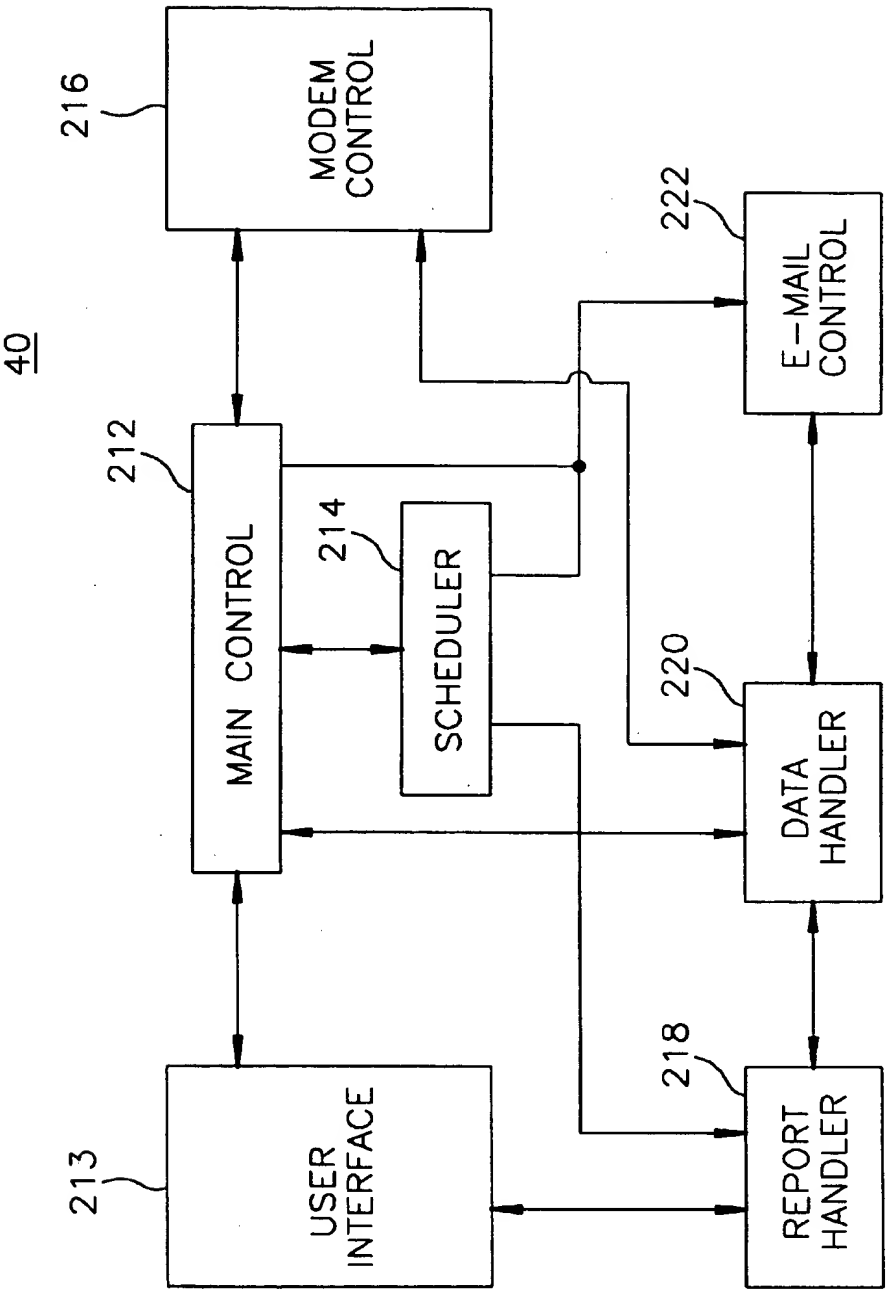
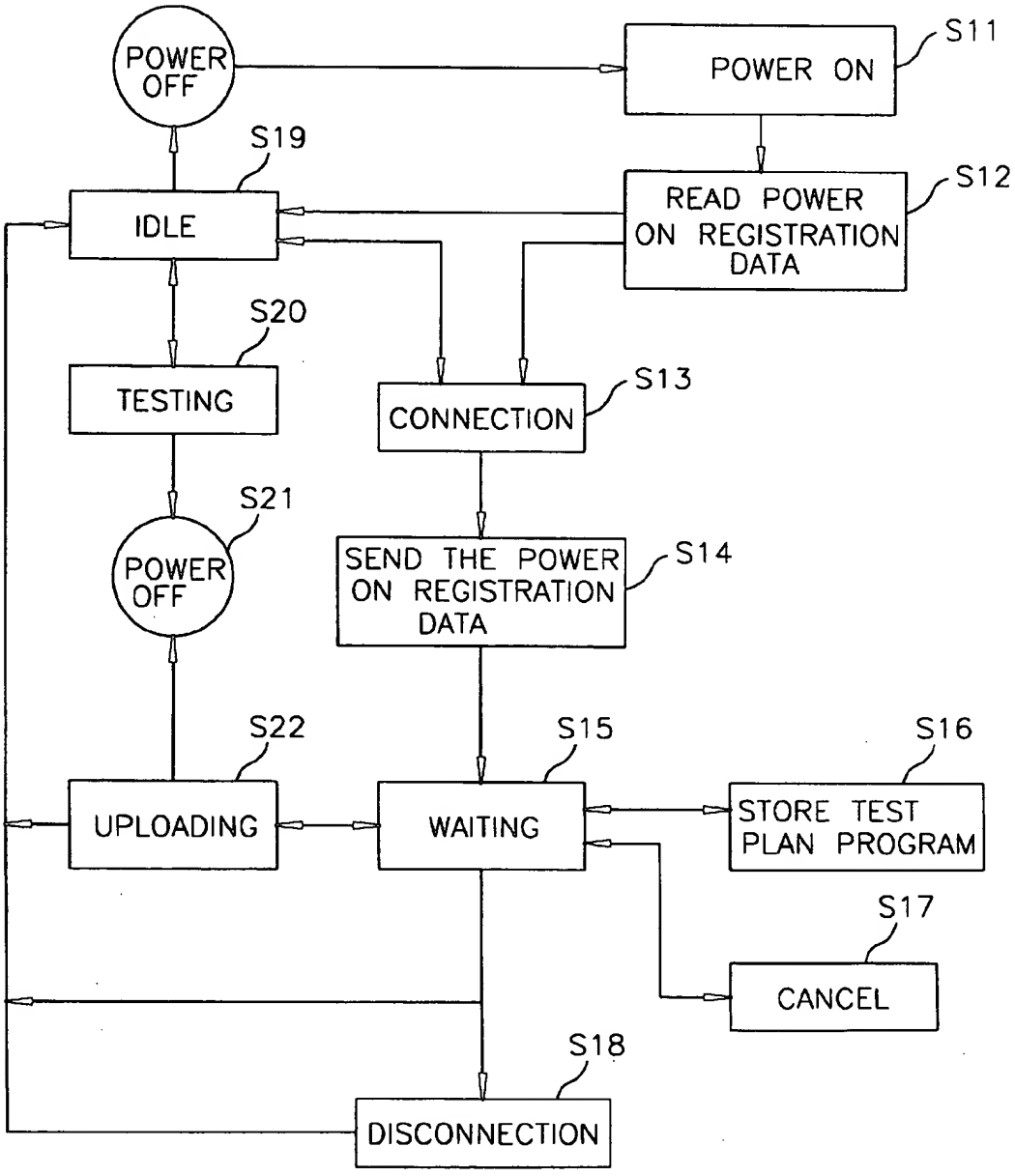

40
216
MODEM CONTROL
222
E-MAIL CONTROL
212
MAIN CONTROL
214
SCHEDULER
220
DATA HANDLER
218
REPORT HANDLER
213
USER INTERFACE

FIG.5


POWER OFF
POWER ON
S11
S19
IDLE
READ POWER ON REGISTRATION DATA
S12
S20
TESTING
CONNECTION
S13
S21
POWER OFF
SEND THE POWER ON REGISTRATION DATA
S14
S22
S15
S16
UPLOADING
WAITING
STORE TEST PLAN PROGRAM
S17
CANCEL
S18
DISCONNECTION

METHOD AND APPARATUS FOR AUTOMATIC CALL TEST IN A CDMA SYSTEM

FIELD OF THE INVENTION

The present invention relates to a code division multiple access(CDMA) system; and, more particularly, to a method and apparatus capable of automatically measuring certain parameter data relating to wireless network environments for call testing.

BACKGROUND OF THE INVENTION

In a telecommunications system such as a CDMA system, there is utilized a performance evaluation equipment to evaluate the performance of a base station or for call testing in the system. For the performance evaluation, the equipment is provided with one or more call testers which are installed at a fixed place or in a movable object, e.g., automobile. By using such a call tester, it is possible to measure various parameter data relating to wireless network environments within a service coverage of a base station. The measured parameter data is then sent to a server of the equipment for the performance evaluation.

Specifically, when there is a request from the tester server to obtain parameter data needed for the performance evaluation, the call tester starts to measure the parameter data through a mobile station(or handset) associated therewith under the control of the tester's operator. The mobile station used in the call tester has a diagnostic monitor(DM) function, wherein the parameter data is measured in accordance with a test plan program issued at the server. The test plan program, as known in the art, may include data indicating a call mode, a call type, etc. The call mode data is data indicating whether a mobile station used for the data measurement is in a call origination state or a call termination state. The call type data is data indicating whether the mobile station is in an idle state or a call-by-call state. To be more specific, the idle state represents a state wherein there is no call origination in the mobile station which is powered up, while the call-by-call state stands for a state wherein the call origination, termination and stand by are repeated on a preset time duration basis.

The parameter data measured according to the test plan program is collected and parsed in order to obtain sets of measured parameter data under the control of the operator, each set having a different kind of measured parameter data. The measured parameter data may contain information on date, time, network identification(NID), base station ID(BID), active count, frame error rate(FER) and the like.

In short, the date data represents the date on which the parameter data is measured, while the time data represents the time at which the parameter data is measured. The date data and the time data may be obtained from a global positioning system(GPS) module associated with the call tester. And the NID data indicates a network ID and the BID data indicates a base station ID. The active count data represents the number of active pilot signals which correspond to channels which are available for calls and may be detected from a status response message from the mobile station. The FER data stands for a frame error rate.

The sets of measured parameter data so obtained are then stored in a storage device for transmission to the server upon the server's request thereof. Prior to storing the sets of measured parameter data, they may be decoded by converting them in an appropriate data format. After storing the sets

of measured parameter data, when there is a data transmission request from the server, the tester operator controls the tester to transmit the sets of measured parameter data to the server through another mobile station with a data service function using a predefined transmission protocol.

The sets of measured parameter data transmitted from the call tester are received by the server and then stored in a database thereof for use in evaluating the performance of the base station in the equipment.

As explained above, in the conventional call tester, the whole procedure to measure, collect, parse and transmit the parameter data is entirely controlled by the tester's operator. This prior art call tester, therefore, has a shortcoming that it requires an extra operator and is very inconvenient.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of the present invention to provide an automatic call test method and apparatus employing a cost-effective and convenient wireless data measurement scheme.

In accordance with one aspect of the present invention, there is provided a method for automatically measuring parameter data relating to wireless network environments within a service coverage of a base station in a code division multiple access(CDMA) system having at least one call tester and a server, which comprises the steps of:

(a) detecting a server's telephone number from power-on registration data representing a current test state stored in a storage device, wherein the power-on registration data contains information indicating a start, interruption and end of the test in the tester;

(b) attempting, at the call tester, a connection with the server through a mobile station with a data service function using the server's telephone number;

(c) if there is test plan program data from the server after the connection is made, starting to measure the parameter data using another mobile station with a diagnostic monitor(DM) function on the basis of the test plan program data; and

(d) collecting and parsing the measured parameter data to obtain sets of measured parameter data, each set having a different kind of measured parameter data, and transmitting the sets of measured parameter data to the server using the mobile station with the data service function when there is a data transmission request from the server.

In accordance with another aspect of the present invention, there is provided an apparatus for automatically measuring parameter data relating to wireless network environments within a service coverage of a base station in a code division multiple access (CDMA) system, which comprises:

means for detecting a server's telephone number from power-on registration data representing a current test state stored in a storage device, wherein the power-on registration data contains information indicating a start, interruption and end of the test in the tester;

means for attempting a connection with the server through a mobile station with a data service function using the server's telephone number;

means for receiving, if there is test plan program data from the server after the connection is made, the test plan program data and measuring the parameter data using another mobile station with a diagnostic monitor (DM) function based on the test plan program data; and

means for collecting and parsing the measured parameter data to obtain sets of measured parameter data, each set having a different kind of measured data, and transmitting the sets of measured parameter data to the server when there is a data transmission request from the server.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments given in conjunction with the accompanying drawings, in which:

FIG. **1** provides a block diagram of a novel performance evaluation equipment in accordance with the present invention; and

FIG. **2** presents a block diagram of the CDMA call tester shown in FIG. **1**;

FIG. **3** depicts a detailed block diagram of the control processor shown in FIG. **2**;

FIG. **4** represents a block diagram of a tester server included in a server module of the CDMA call tester; and

FIG. **5** offers a flow chart for describing the whole procedure for automatically measuring parameter data regarding wireless network environment in a CDMA system and transferring it to the tester server upon its request.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, there is provided a block diagram of a performance evaluation system **100** incorporating therein one or more CDMA call testers, e.g., **10-1** and **10-2**, in accordance with the present invention. These CDMA call testers may be installed at any fixed place in a CDMA system(not shown). Alternatively, the testers may be installed in a movable object, e.g., an automobile (not shown); and, in this case, it is possible to measure various parameter data relating to wireless network environments within a service coverage of a base station(not shown) in the CDMA system even when the automobile is moving. By using the CDMA call tester of the invention, it enables the performance evaluation system **100** to automatically measure the parameter data and evaluate the performance of the base station using the measured parameter data.

To be more specific, in the call tester, when there is a test request from a server module **40** connected thereto by radio, parameter data relating to wireless network environments within a service coverage of a base station is automatically measured under the control of the server module **40**. After measuring the parameter data, it is automatically sent to the server module **40** through a communications network **20** upon the module **40**'s request thereof. Therefore, the system **100** does not require operators for the CDMA call testers beside the server module **40**'s operator; and, thus, it is cost-effective and very convenient.

In accordance with a preferred embodiment of the present invention, the system **100** is capable of measuring new parameter data while transmitting the measured parameter data to the server module **40**. Although there is not fully shown in FIG. **1**, it should be noted that there are used a mobile station with a data service function and another mobile station with a DM function which are associated with each of the CDMA call testers.

Turning now to FIG. **2**, there is illustrated a block diagram of one of the two CDMA call testers, e.g., **10-1**, as depicted in FIG. **1**. The CDMA call tester **10-1** includes a control processor **110**, a GPS module **120**, a read only memory (ROM) **140**, a random access memory(RAM) **150** and a flash memory **160**.

The control processor **110** is a main processor to control the operation of all devices in the tester **10-1** and manage communications with the server module **40** and the flash memory **160**. Also, the processor **110** controls the operation of the mobile stations associated with the tester **10-1**. Details of the operation in the processor **110** will be provided with reference to FIG. **3** later. The GPS module **120** provides the control processor **110** with data representing a position at which the tester **10-1** is currently together with data on a current time. In a preferred embodiment of the invention, a GPS developed by Motorola Incorporation may be advantageously used for the above-mentioned purpose.

The ROM **140** stores operating system(OS) and system program and transfers same to the RAM **150** for loading it immediately after a power is supplied to the tester **10-1**. The flash memory **160** functions to save all parameter data to be measured and transmits same to the server module **40** through the network **20** upon the request. The memory **160** can maintain all the data stored therein even in the event of a power off; and may also be used as a space for remote upgrade of software programs embedded in the tester **10-1** when needed. Further, the memory **160** stores power-on registration data representing a current test state and provides same to the block **110** when desired. The power-on registration data may include information indicating a start, interruption and end of the test in the tester **10-1**, a server's telephone number and the like.

Referring to FIG. **3**, there is illustrated a detailed block diagram of the control processor **110** in accordance with the present invention shown in FIG. **2**. The processor **110** includes a main control block **122**, a DM control block **124**, a call control block **126**, a data handler **128**, a data communications block **130** and a GPS interface block **132**.

Specifically, the main control block **122** is used to control the operation of the whole system and other blocks in the processor **110**, as will further be explained later. The DM control block **124** periodically sends a DM data request to the mobile station with the DM function in accordance with a test plan program issued at the server module **40** and relays parameter data measured through the mobile station in response to the request to the call control block **126** for logging it into the flash memory **160**. Prior to logging the measured parameter data, the data may be decoded by converting it in an appropriate data format. Details of the test plan program and the measured parameter data will be given when describing the whole procedure of the present invention with reference to FIG. **5** later. The call control block **126** serves to control calls of the mobile stations, and call origination and release in accordance with the test plan program. Also, this block interacts with the DM control block **124** to collect and parse the measured parameter data delivered through the DM control block **124**.

The data handler **128** performs function to save the test plan program from the server module **40** into the flash memory **160**. Also, the handler **128** controls the logging of the measured parameter data which has been collected and parsed at the call control block **126** and the position data through the GPS interface block **132** from the GPS module **120** into the flash memory **160**. The data communications block **130** executes access to the server module **40** through the mobile station with the data service function when there is a data transmission request from the server module **40**.

When the access process has been completed, the block **130** sends the measured parameter data stored in the flash

memory **160** to the server module **40** using one of known data transmission protocols. To be more specific, the block **130** first turns on a power of the mobile station with the data service function and controls the mobile station to connect it to a modem pool(not shown) in the server module **40**. When connected, the block **130** waits for until there is a data transmission request from the server module **40**. When the request is received by the block **130**, it transmits the measured parameter data to the sever module **40** through an inter working function(IWF) module(not shown) and the modem pool. Finally, the GPS interface block **132** receives and converts the position data and the current time data from the GPS module **120** to data with a preset format which is adapted to save it in the flash memory **160**. As shown, there is used in FIG. **3** a data bus, **125**, in order to communicate data and/or messages among the blocks **122, 124, 126, 128, 130, 132**.

FIG. **4** depicts a detailed block diagram of the server module **40** shown in FIG. **1**. The module **40** includes a tester server which converts the measured parameter data from the tester **10-1** to data with a preset format for analysis thereof and manages and controls the tester **10-1** based on the analysis result. Even though there is not shown in FIG. **4** for simplicity, it should be noted that the module **40** is associated with a short message service center(SMSC), a modem pool and an IWF to communicate data between itself and the tester **10-1**. Details of the SMSC, the modem pool and the IWF will be provided when explaining the whole procedure of the present invention with reference to FIG. **5** later.

The tester server, as shown in FIG. **4**, includes a main control block **212**, a user interface block **213**, a scheduler **214**, a modem control block **216**, a report handler **218**, a data handler **220** and an e-mail control block **222**. The main control block **212**, which monitors the operation of other blocks in the server and interfaces with the user interface block **213**, creates and manages a predetermined process(or thread) and resources of the tester server in order to manage and control the tester **10-1**. The user interface block **213** handles data used for a user to operate the tester server; and runs on windows and supports a graphic user interface for easy operation. Also, this block interfaces with the call tester **10-1** to provide interface for command transmission to the tester **10-1** and resource management. The scheduler **214** records test schedules to perform call tests at a designated time and interval given by the server operator and manages a daily report, an e-mail notification and a home page control.

The modem control block **216** controls the operation of a dialup modem(not shown) fitted in the tester server wherein the modem is used to provide function for automatic answering to calls through the mobile station from the tester **10-1**. The automatic answering process is controlled by the main control block **212** which monitors the operation of the block **216**. The e-mail control block **222** handles an internet e-mail system(not shown) to send data and/or messages such as the test plan program to the tester **10-1** using a short message service(SMS). This block also controls a mailing function to deliver certain reports to the SMSC via e-mail. Then, the SMSC will send messages corresponding to the reports to the mobile station using the SMS to transfer same to the tester **10-1**.

The data handler **220** is to save the measured parameter data or any other information data transmitted through the modem pool from the call tester **10-1** into a preset database. Also, the handler **220** performs function to deliver query for data requested by other blocks in the tester server to the database. The report handler **218** performs function to automatically create reports requested by the user and generate printed reports through a printer connected thereto.

In addition, the tester server may include a data analyzer (not shown), which is one of software tools, to analyze the measured parameter data provided from the tester **10-1** for the performance evaluation of the base station. There may be two ways to communicate between the tester server and the tester **10-1**. Specifically, the SMS is used for connecting the tester server to the tester **10-1**, while the data service is used to transmit the measured parameter data from the tester **10-1** to the tester server.

Hereinafter, a procedure of automatically measuring certain parameter data relating to wireless network environments and sending same to the tester server upon the server's request thereof will be described with reference to FIG. **5** in parallel with FIGS. **1–4**.

The process of the present invention is initiated when a power is supplied to the tester **10-1**. Specifically, if the tester **10-1** is powered up at step **S11**, the main control block **122** reads power-on registration data stored in the flash memory **160** at step **S12**. If a telephone number of the server is detected from the power-on registration data, then at step **S13** the block **122** attempts a connection with the server module **40** using the mobile station with the data service function and, if otherwise, the process goes to step **S19** to stand by in an idle state. In the idle state, if there is a call from the tester server using the SMS, the block **122** again attempts a connection with the tester server **40** through the mobile station using the server's telephone number contained in the SMS.

Once the connection has been made, at step **S14** the block **122** sends the module **40** the power-on registration data together with the position data; and, thereafter, the process goes to step **S15** to wait for until there are any instructions from the module **40**. After sending the above data, if plan set instructions including the test plan program are received by the block **122**, at step **S16** the test plan program is extracted therefrom and stored in the flash memory **160** together with the position data and current time data issued from the GPS module **120**. The test plan program may include data indicating a call mode, call type, calling time, idle time, call count, start time, etc.

The call mode data and the call type data are the same as those explained in the Background of the Invention; and, therefore, details thereof are omitted here. The calling time data represents interval of time during which a call is continued in the call-by-call state and the idle time data indicates interval of time during which no call is originated in the idle state. And the call count data stands for the total number of times of occurrence of the call origination and termination and the start time data represents a test start time.

After storing the test plan program, the position data and the current time data, the block **122** makes the connection with the module **40** disconnected at step **S18** and the process returns to step **S19** to remain in the idle state. In the idle state, if it is reached the test start time set in the test plan program, at step **S20** the block **122** starts to measure parameter data through the mobile station with the DM function according to the test plan program. The parameter data measured according to the test plan program is collected and parsed to obtain sets of measured parameter data, each having a different kind of measured parameter data. As fully described above, the blocks, **124, 126, 128, 132**, are also used to measure, gather and parse the parameter data and obtain the sets of measured parameter data.

The measured parameter data may contain data on date, time, call count, call type, fail reason, network ID(NID), BID, SID, CDMA channel number, pilot pseudonoise(PN) offset, Ec/Io, call setup time, calling time, data count, latitude, longitude, active count, candidate count, neighbor count, best PN & Ec/Io, Rx power, Tx power adjust, channel state, call event, FER, etc. The call type data, the date data, the time data, the NID data, the BID data, the calling time, the active count data, the FER data are the same as those explained above and in the Background of the Invention; and, therefore, details thereof are omitted here. The remaining terms will be briefly explained below.

That is to say, the fail reason data describes a failure reason in the event of call failure and may be obtained from a status response message from the mobile station with the DM function. The pilot PN offset data represents pilot signals with the amounts of different delay and may also be obtained from the status response message. The Ec/Io data indicates Ec/Io of the pilot signals with the amounts of different delay and may be derived from a power value in the status response message. The call setup time data represents a time duration starting from input of a telephone number to make a call to receipt of a ring back signal, i.e., to a time at which the call is made. The data count data indicates the number of the different kinds of measured parameter data as mentioned above.

Further, the latitude data and the longitude data indicate a latitude and a longitude of the tester **10-1** at which it is currently positioned in the system **100**, respectively, and may be obtained through the GPS interface block **132** from the GPS module **120**. The candidate count data indicates the number of candidate pilot signals which can be used as active pilot signals and may also be obtained from the status response message. The neighbor count data represents all pilot signals except the active and the candidate pilot signals and may also be derived from the status response message. The best PN & Ec/Io data describe PN and Ec/Io of the best active pilot signal among the active pilot signals, respectively, and may also be obtained from the status response message. The Rx and Tx power data represent a receiving power and a transmitting power, respectively, and may also be obtained from the status response message. The Tx power adjust data represents a reference signal used to adjust the transmitting power and may be derived from a temporal analyzer graph response from the mobile station. The channel state data represents a status of a channel through which the service is being made. The call event represents a status of call and may be obtained from the call mode data.

If the test process has successfully been completed, then the sets of measured parameter data are logged into the flash memory **160** for transmission to the server module **40**. The completion of the process, for example, may be detected by monitoring and counting the repeated number of times of the call-by-call test and the idle test.

Thereafter, the process returns to step **S19** to stand by in the idle state and then attempts a connection with the server module **40** according to the test plan program. If the connection has been made, the block **122** informs the module **40** of the power-on registration data and waits for until there are any further instructions from the server module **40** at step **S15**. If there are data request instructions from the module **40**, at step **S22** the block **122** starts to transmit the sets of measured parameter data logged into the flash memory **160** to the module **40** through the components coupled therebetween. If the data transmission has been completed, then the process cuts off the connection with the module **40** at step **S18** and then returns to step **S19** to remain in the idle state.

After sending the power-on registration data at step **S14**, if there are data cancel instructions from the module **40**, at step **S17** the block **122** may eliminate all data logged into the flash memory **160** and cut off the connection with the module **40** at step **S18**; and, thereafter, the process returns to step **S19** to stay in the idle state. In the idle state, the tester **10-1** is always power on but may be power off by mistake or due to an instantaneous power failure.

In addition, if the test process is interrupted due to a disruption of the supply of the power to the tester **10-1** during the test operation at step **S20**, all measured data stored in the flash memory **160** may be sent to the module **40** immediately. Further, if there occurs a disconnection in the communications with the module **40** during the uploading of the sets of measured parameter data at step **S22**, the process may return to step **S19** and then may attempt a connection with the module **40** at step **S13**. If the connection has been made, the block **122** informs the module **40** of the power-on registration data including the disconnection information at step **S14**. Thereafter, if there are data resending request instructions from the module **40**, the block **122** resends the sets of measured parameter data to the module **40** at step **S22** and cuts off the connection with the module **40**; and then also returns to step **S19** to remain in the idle state. However, if the power to the tester **10-1** is off during the transmission of the sets of measured parameter data, it is possible to resend same to the module **40** only when the power is resupplied to the tester **10-1**.

As described early, the call test method and apparatus in accordance with the present invention employ an efficient call test scheme which automatically measures various parameter data regarding wireless network environments and send same to the server upon the request. The invention, therefore, has an advantage compared to the prior art call tester in that the it does not require an operator and is very convenient in view of the above.

While the present invention has been shown and described with respect to the particular embodiments, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A method for automatically measuring parameter data relating to wireless network environments within a service coverage of a base station in a code division multiple access(CDMA) system having at least one call tester and a server, which comprises the steps of:

(a) detecting a server's telephone number from power-on registration data representing a current test state stored in a storage device, wherein the power-on registration data contains information indicating a start, interruption and end of the test in the tester;

(b) attempting, at the call tester, a connection with the server through a mobile station with a data service function using the server's telephone number;

(c) if there is test plan program data from the server after the connection is made, starting to measure the parameter data using another mobile station with a diagnostic monitor(DM) function on the basis of the test plan program data; and

(d) collecting and parsing the measured parameter data to obtain sets of measured parameter data, each set having a different kind of measured parameter data, and transmitting the sets of measured parameter data to the server using the mobile station with the data service function when there is a data transmission request from the server.

2. The method of claim 1, wherein the call tester is installed at a fixed place.

3. The method of claim 1, wherein the call tester is installed in a movable object.

4. The method of claim 3, wherein, at the step(c), the parameter data is measured by using information representing a position at which the call tester is currently located in the CDMA system when reaching a test start time included in the test plan program data.

5. The method of claim 4, wherein the position information is obtained from a global positioning system associated with the call tester.

6. The method of claim 5, wherein the step(c) includes the steps of:

(c1) receiving, at a short message service center(SMSC) connected to the server, the test plan program data from the server via e-mail and sending it to the mobile station with the data service function by using a short message service(SMS); and

(c2) receiving, at the mobile station, the test plan program data from the SMSC and relaying it to the call tester via a communications network.

7. The method of claim 1, wherein the step(d), prior to transmitting the sets of measured parameter data, includes the step of decoding and storing them in the storage device.

8. The method of claim 7, wherein the step(d) includes the steps of:

(d1) turning on a power of the mobile station with the data service function and attempting a connection with a modem connected to the server; and

(d2) if there is the data transmission request from the server after the connection is made, sending the sets of decoded measured parameter data stored in the storage device to the server through the modem using an inter working function.

9. An apparatus for automatically measuring parameter data relating to wireless network environments within a service coverage of a base station in a code division multiple access(CDMA) system, which comprises:

means for detecting a server's telephone number from power-on registration data representing a current test state stored in a storage device, wherein the power-on registration data contains information indicating a start, interruption and end of the test;

means for attempting a connection with the server through a mobile station with a data service function using the server's telephone number;

means for receiving, if there is test plan program data from the server after the connection is made, the test plan program data and measuring the parameter data using another mobile station with a diagnostic monitor (DM) function based on the test plan program data; and

means for collecting and parsing the measured parameter data to obtain sets of measured parameter data, each set having a different kind of measured parameter data, and transmitting the sets of measured parameter data to the server when there is a data transmission request from the server.

10. The apparatus of claim 9, wherein the apparatus is installed at a fixed place.

11. The apparatus of claim 9, wherein the apparatus is installed in a movable object.

12. The apparatus of claim 11, wherein the parameter data is measured by using information representing a position at which the apparatus is currently located in the CDMA system when reaching a test start time included in the test plan program data.

13. The apparatus of claim 12, wherein the position information is obtained from a global positioning system associated with the apparatus.

14. The apparatus of claim 13, wherein the receiving and measuring means includes:

a short message service center(SMSC) for receiving the test plan program data from the server via e-mail and sending it to the mobile station with the data service function by using a short message service(SMS); and

means for receiving the test plan program data from the mobile station via a communications network.

15. The apparatus of claim 11, wherein the collecting, parsing and transmitting means, prior to transmitting the sets of measured parameter data, includes means for decoding and storing them in the storage device.

16. The apparatus of claim 15, wherein the collecting, parsing and transmitting means includes:

means for turning on a power of the mobile station with the data service function and attempting a connection with a modem connected to the server; and

means for sending, if there is the data transmission request from the server after the connection is made, the sets of decoded measured parameter data stored in the storage device to the server through the modem using an inter working function.

17. A data communications system in a code division multiple access(CDMA) system, the data communications system having a call tester and a server, wherein the call tester comprises:

means for detecting a server's telephone number from power-on registration data representing current test state stored in a storage device, wherein the power-on registration data contains information relating to a start, interruption and end of the test in the tester;

means for attempting a connection with the server through a mobile station with a data service function using the server's telephone number;

means for receiving, if there is test plan program data from the server after the connection is made, the test plan program data and measuring parameter data relating to wireless network environments within a service coverage of a base station in the CDMA system using another mobile station with a diagnostic monitor(DM) function based on the test plan program data; and

means for collecting and parsing the measured parameter data to obtain sets of measured parameter data, each set having different kind of measured data, and transmitting the sets of measured parameter data to the server when there is a data transmission request from the server; and wherein the server comprises:

means for providing test schedules for the call tester to operate based thereon;

means for handling data input and output for the server user to operate the server and supporting a graphic user interface;

means for handling internet e-mail system to send messages including the test plan program data to the call tester and deliver reports to the mobile station with the data service function; and

means for saving the sets of measured parameter data transmitted through the mobile station and a modem from the call tester in a database.

18. The system of claim 17, wherein the call tester is installed in a movable object.

19. The system of claim 18, wherein the parameter data is measured by using information representing a position at which the call tester is currently located in the CDMA system when reaching a test start time included in the test plan program data.

20. The system of claim 19, wherein the position information is obtained from a global positioning system associated with the call tester.

* * * * *

US005933675A

United States Patent [19]

Sawada et al.

[11] Patent Number: 5,933,675

[45] Date of Patent: *Aug. 3, 1999

[54] **CENTRALIZED CONTROL SYSTEM FOR TERMINAL DEVICE**

[75] Inventors: **Yoji Sawada**, Motosu; **Toru Kirimura**, Tsushima; **Seiji Watanabe**, Ogaki; **Kazunobu Maekawa**, Toyokawa; **Sumiaki Hirata**, Hoi, all of Japan

[73] Assignees: **Sanyo Electric Col., Ltd.**; **Minolta Camera Kabushiki Kaisha**, both of Osaka, Japan

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **08/783,119**

[22] Filed: **Jan. 14, 1997**

Related U.S. Application Data

[63] Continuation of application No. 08/203,684, Feb. 28, 1994, Pat. No. 5,631,724, which is a continuation of application No. 07/905,065, Jun. 24, 1992, abandoned, which is a continuation of application No. 07/682,511, Apr. 8, 1991, abandoned.

[30] **Foreign Application Priority Data**

Apr. 10, 1990	[JP]	Japan	2-95665
Apr. 10, 1990	[JP]	Japan	2-95666
Apr. 10, 1990	[JP]	Japan	2-95667

[51] **Int. Cl.**[6] **G03G 21/00**

[52] **U.S. Cl.** **399/8**; 399/10; 399/24

[58] **Field of Search** 399/8, 10, 24; 364/189, 185, 186; 379/106

[56] **References Cited**

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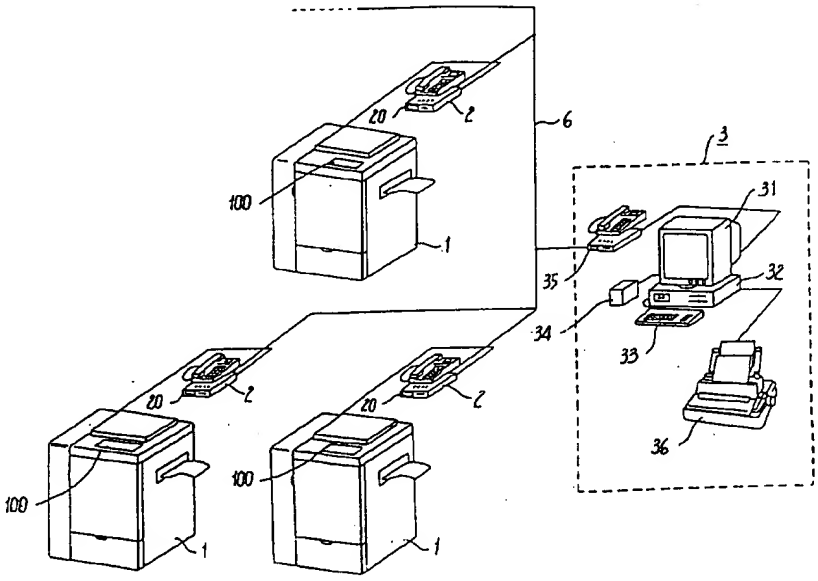
Primary Examiner—William J. Royer
Attorney, Agent, or Firm—Darby & Darby

[57] **ABSTRACT**

A central control system that monitors and remotely controls one or more terminal devices which may be part of an apparatus such as an imaging machine. Each terminal device communicates with the central control system at a predetermined time and relays the operational conditions of the apparatus to which it is associated. Relayed conditions may include information such as the number of imaging operations performed in a period of time. The central control system controls each of the terminal devices in accordance with the information transmitted from each of the terminal devices. The central control system supervises incoming transmissions from the terminal devices and detects when a terminal device has not communicated at its predetermined time. When this condition arises, the identity of the non-reporting terminal, as well as the predetermined time it was to have contacted the central control system, are displayed at the central control system.

3 Claims, 22 Drawing Sheets



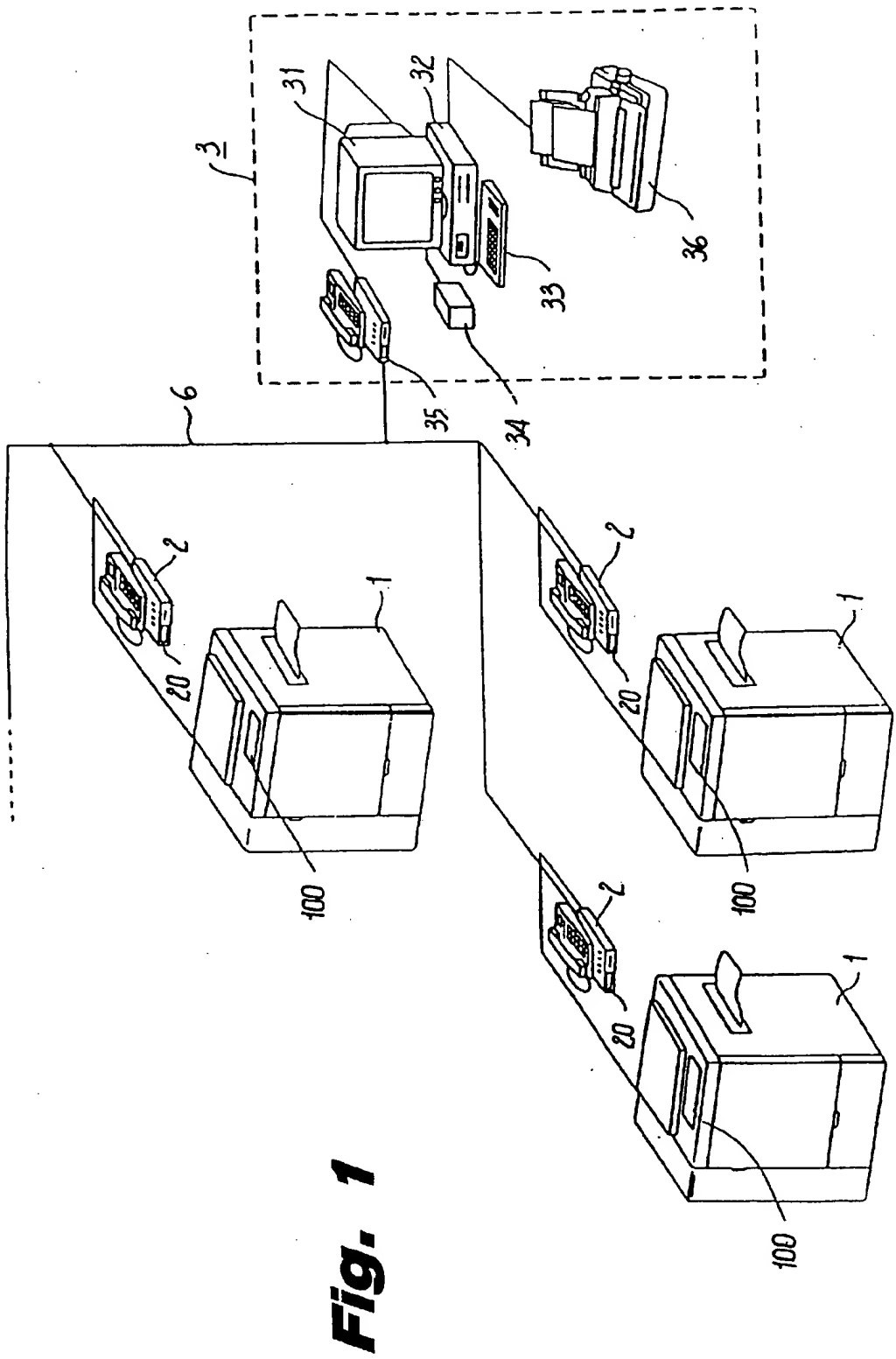


Fig. 1

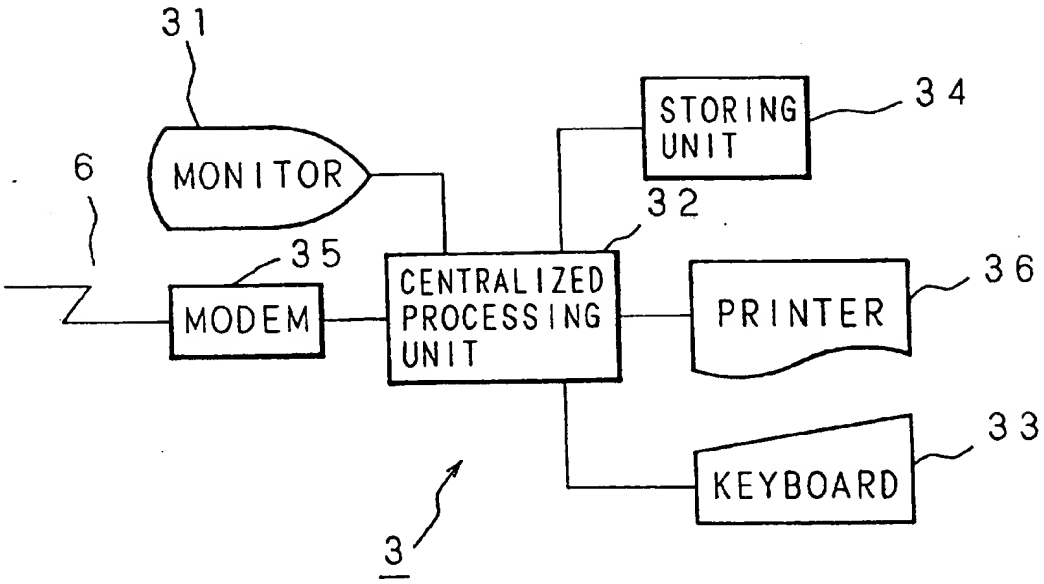

31
MONITOR
6
35
MODEM
CENTRALIZED PROCESSING UNIT
32
STORING UNIT
34
PRINTER
36
KEYBOARD
33
3

Fig. 2

Fig. 3

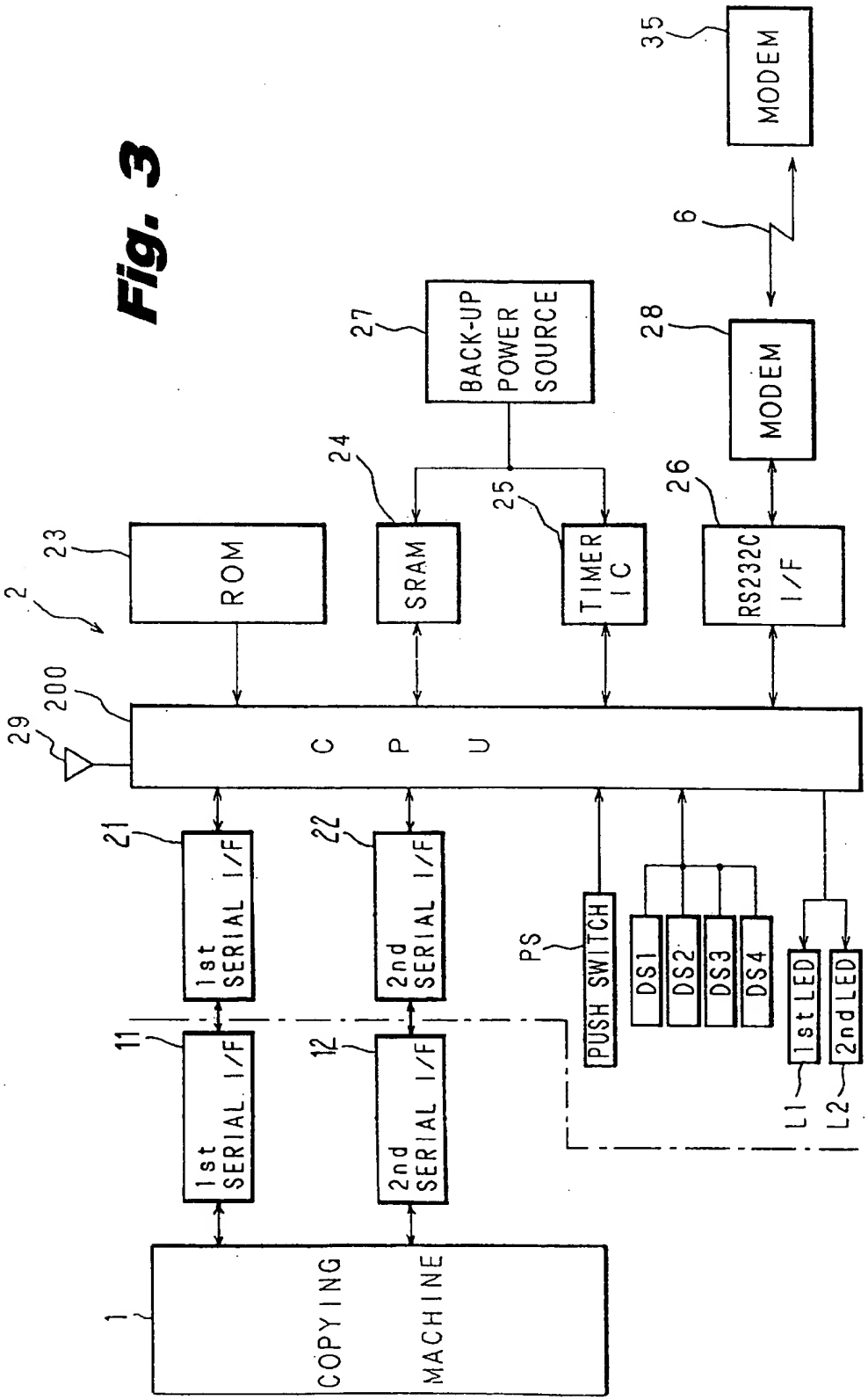

35
MODEM
6
27
BACK-UP POWER SOURCE
28
MODEM
24
25
26
23
ROM
SRAM
TIMER IC
RS232C I/F
2
200
29
C P U
21
1st SERIAL I/F
22
2nd SERIAL I/F
PS
PUSH SWITCH
DS1
DS2
DS3
DS4
1st LED
2nd LED
11
1st SERIAL I/F
12
2nd SERIAL I/F
L1
L2
1
COPYING MACHINE

Fig. 4

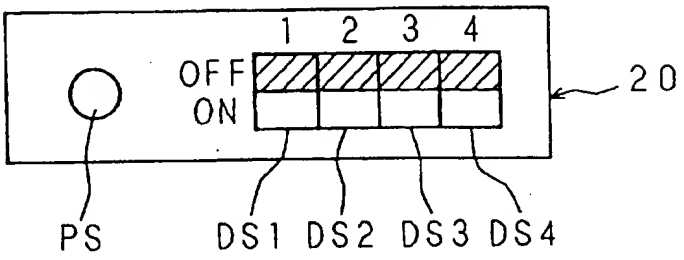
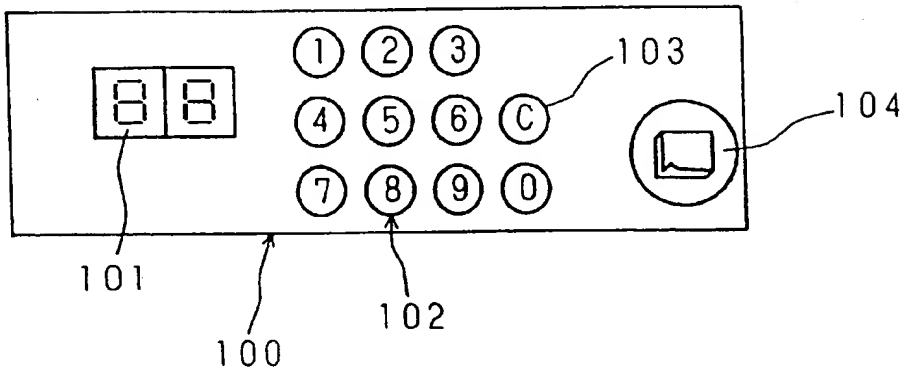

1 2 3 4
OFF
ON
20
PS
DS1 DS2 DS3 DS4

Fig. 5


1 2 3
4 5 6 C
7 8 9 0
103
104
101
102
100

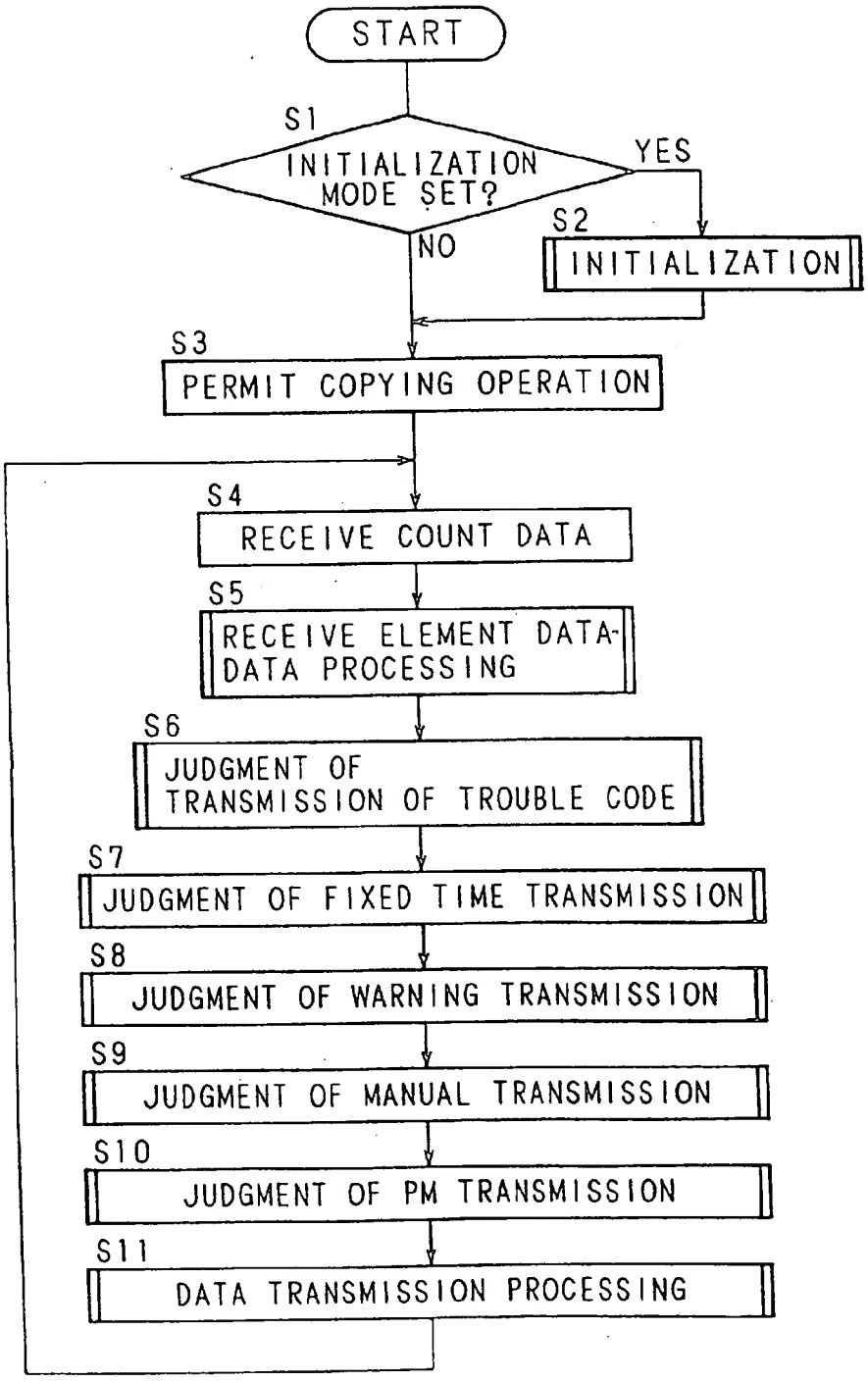

START
S1
INITIALIZATION MODE SET?
YES
NO
S2
INITIALIZATION
S3
PERMIT COPYING OPERATION
S4
RECEIVE COUNT DATA
S5
RECEIVE ELEMENT DATA-DATA PROCESSING
S6
JUDGMENT OF TRANSMISSION OF TROUBLE CODE
S7
JUDGMENT OF FIXED TIME TRANSMISSION
S8
JUDGMENT OF WARNING TRANSMISSION
S9
JUDGMENT OF MANUAL TRANSMISSION
S10
JUDGMENT OF PM TRANSMISSION
S11
DATA TRANSMISSION PROCESSING

Fig. 6

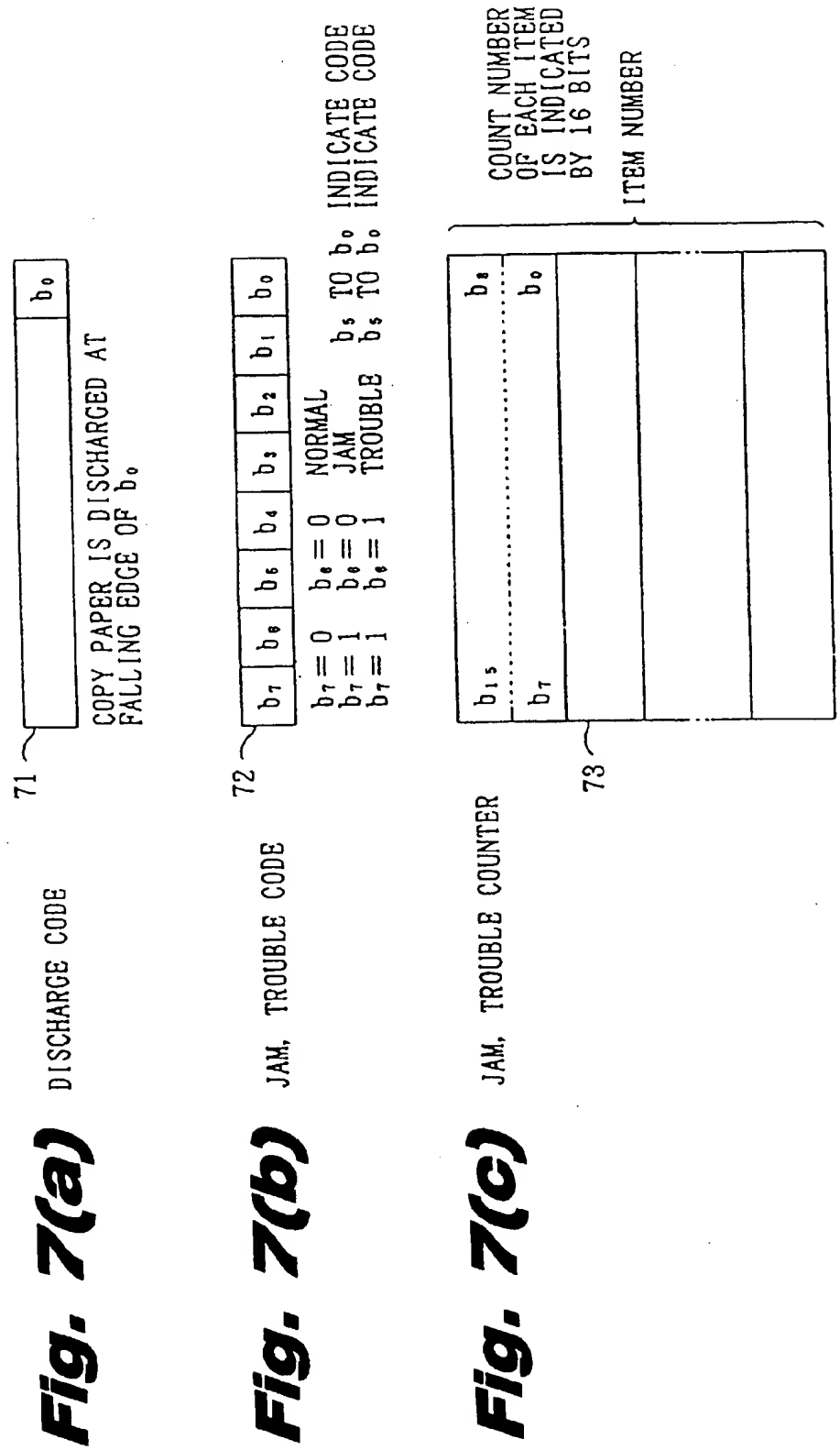


Fig. 7(a)

Fig. 7(b)

Fig. 7(c)

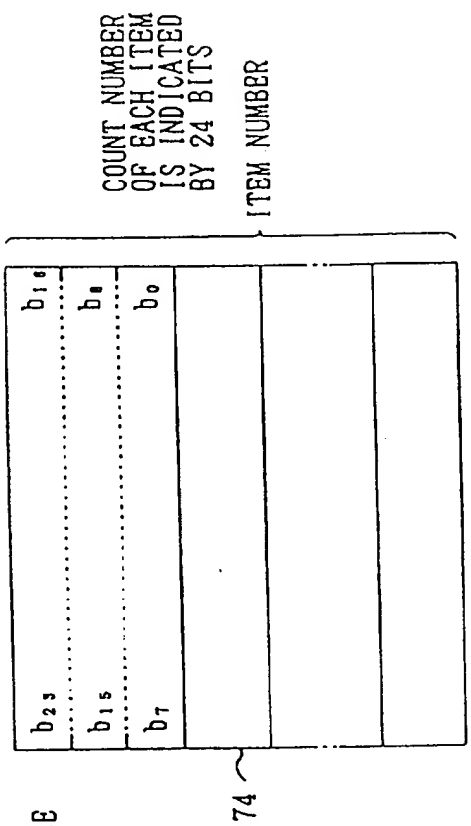


Fig. 7(d) COUNTER FOR EACH SIZE OF COPY PAPER

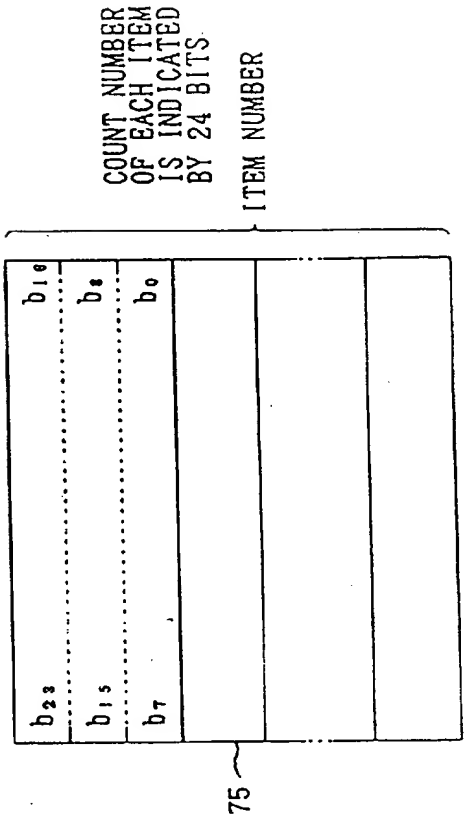


Fig. 7(e) PM COUNTER

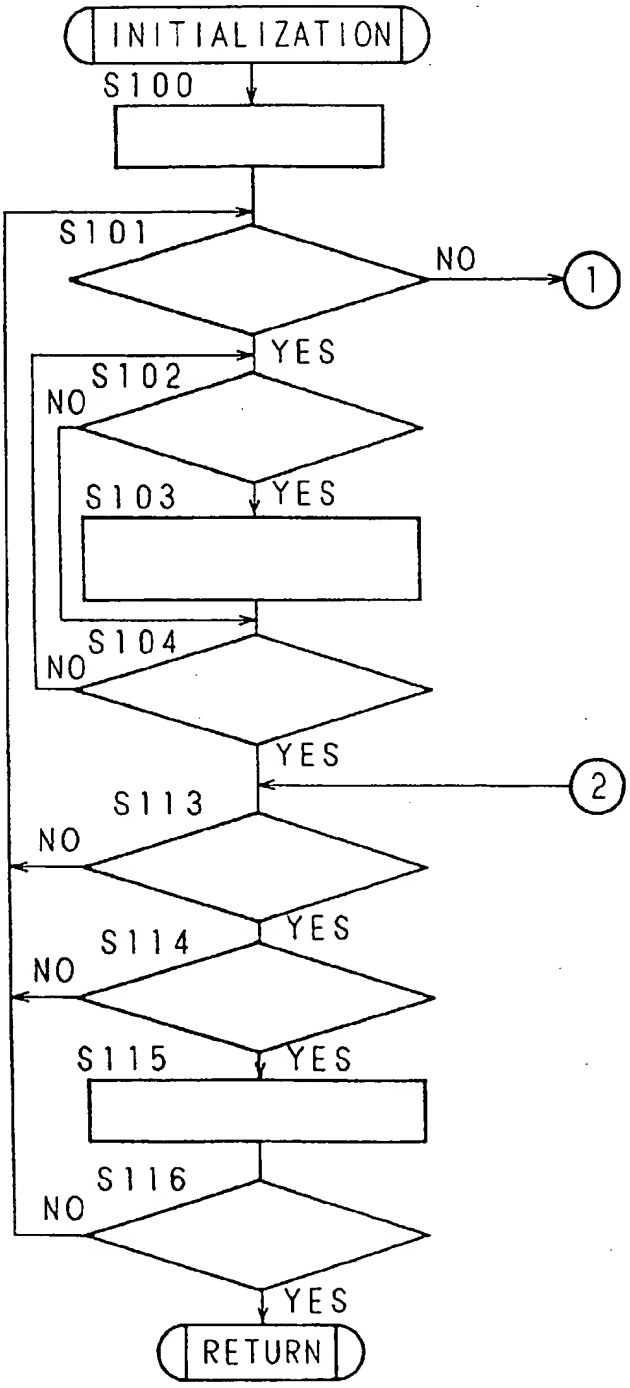

INITIALIZATION
S100
S101
NO
1
YES
S102
NO
S103
YES
S104
NO
YES
2
S113
NO
YES
S114
NO
S115
YES
S116
NO
YES
RETURN

Fig. 8(a)

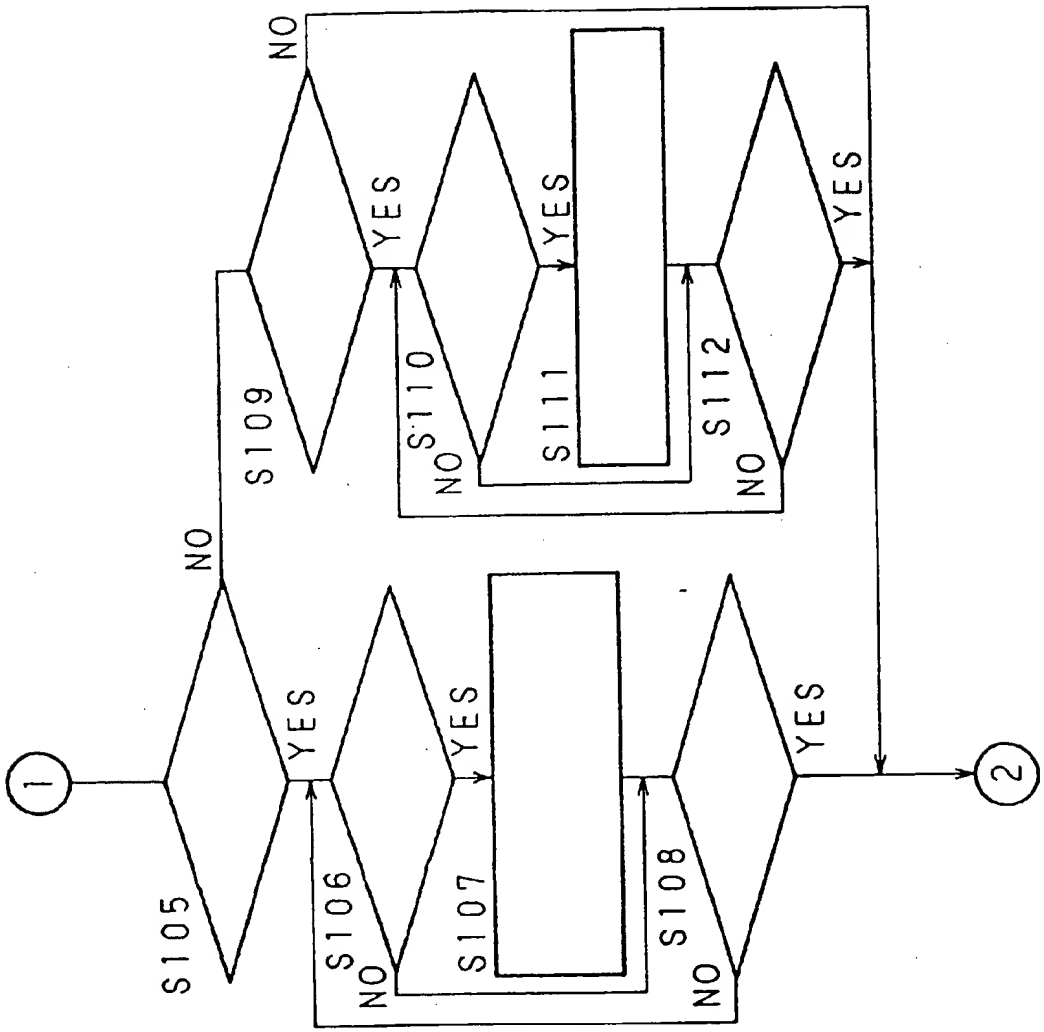

NO
YES
S109
S110
NO
YES
S111
S112
NO
YES
NO
S105
S106
NO
YES
S107
S108
NO
YES
1
2

Fig. 8(b)

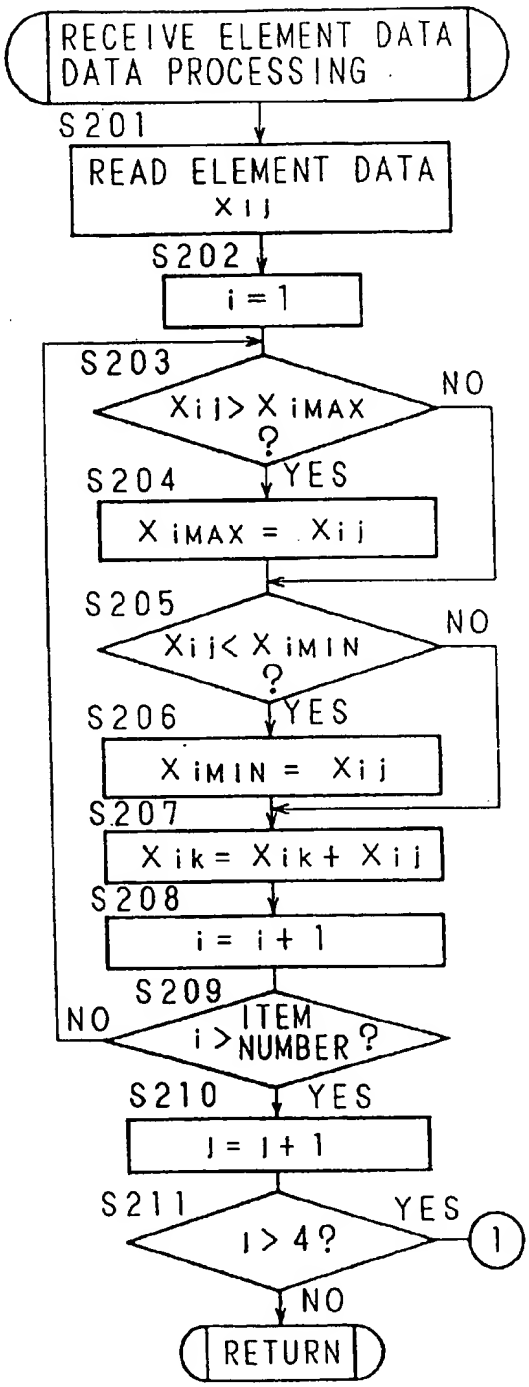

RECEIVE ELEMENT DATA
DATA PROCESSING
S201
READ ELEMENT DATA
Xij
S202
i=1
S203
Xij> XiMAX ?
NO
YES
S204
XiMAX = Xij
S205
Xij< XiMIN ?
NO
YES
S206
XiMIN = Xij
S207
Xik= Xik+ Xij
S208
i= i+ 1
S209
i >ITEM NUMBER ?
NO
YES
S210
J= J+ 1
S211
J> 4?
YES
1
NO
RETURN

Fig. 9(a)

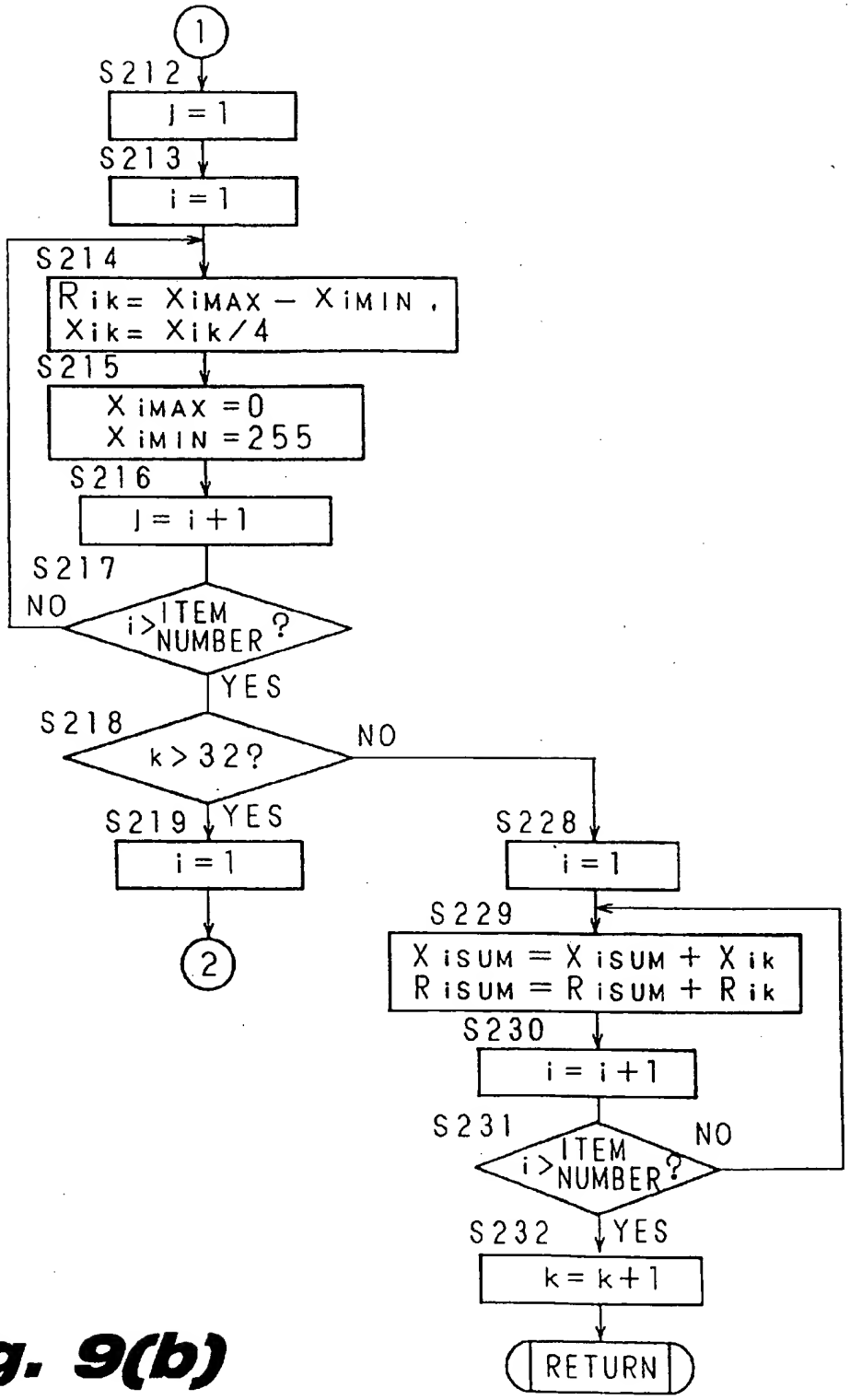

1
S212
j = 1
S213
i = 1
S214
Rik = XiMAX − XiMIN ,
Xik = Xik/4
S215
XiMAX = 0
XiMIN = 255
S216
j = i + 1
S217
NO
i > ITEM NUMBER ?
YES
S218
k > 32?
NO
S219
YES
i = 1
2
S228
i = 1
S229
XiSUM = XiSUM + Xik
RiSUM = RiSUM + Rik
S230
i = i + 1
S231
NO
i > ITEM NUMBER ?
S232
YES
k = k + 1
RETURN

Fig. 9(b)

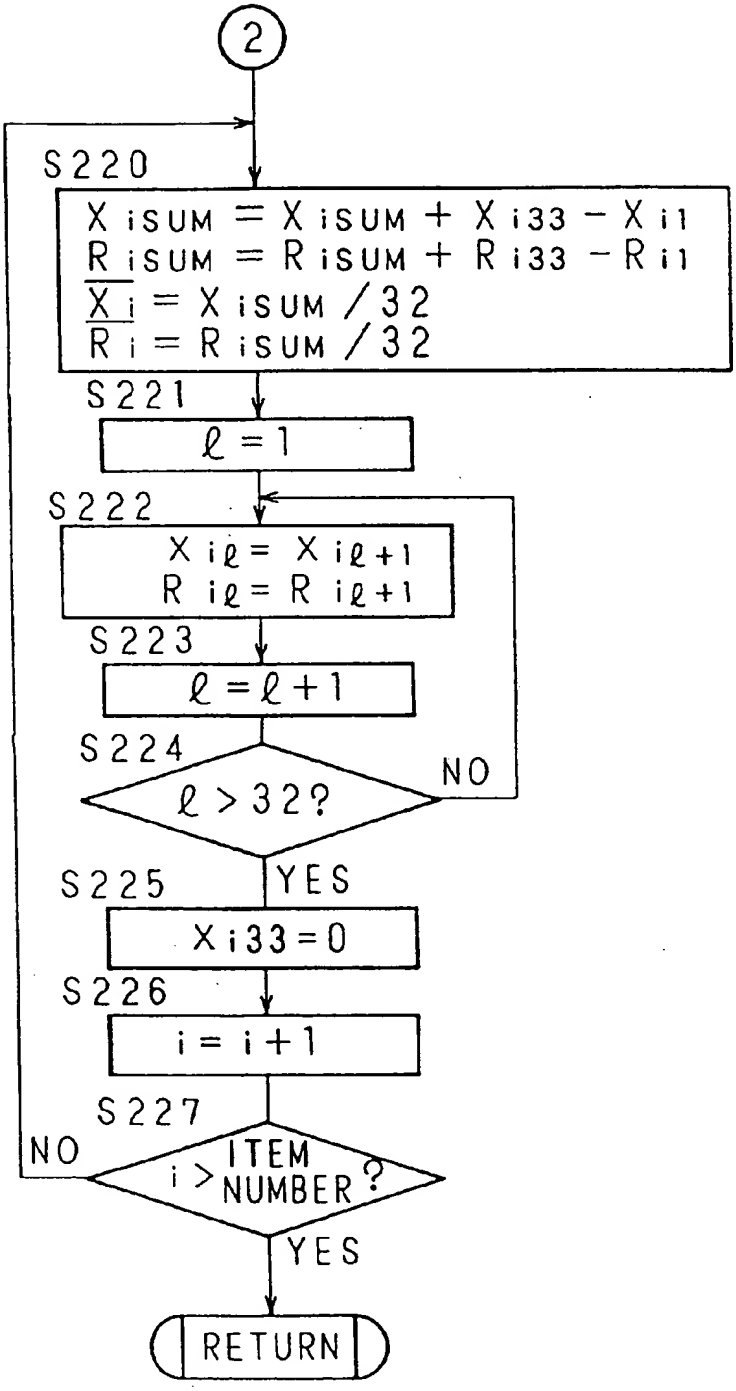

2
S220
X iSUM = X iSUM + X i33 − X i1
R iSUM = R iSUM + R i33 − R i1
X̄ i = X iSUM / 32
R̄ i = R iSUM / 32
S221
ℓ = 1
S222
X iℓ = X iℓ+1
R iℓ = R iℓ+1
S223
ℓ = ℓ + 1
S224
ℓ > 32?
NO
YES
S225
X i33 = 0
S226
i = i + 1
S227
i > ITEM NUMBER?
NO
YES
RETURN

Fig. 9(c)

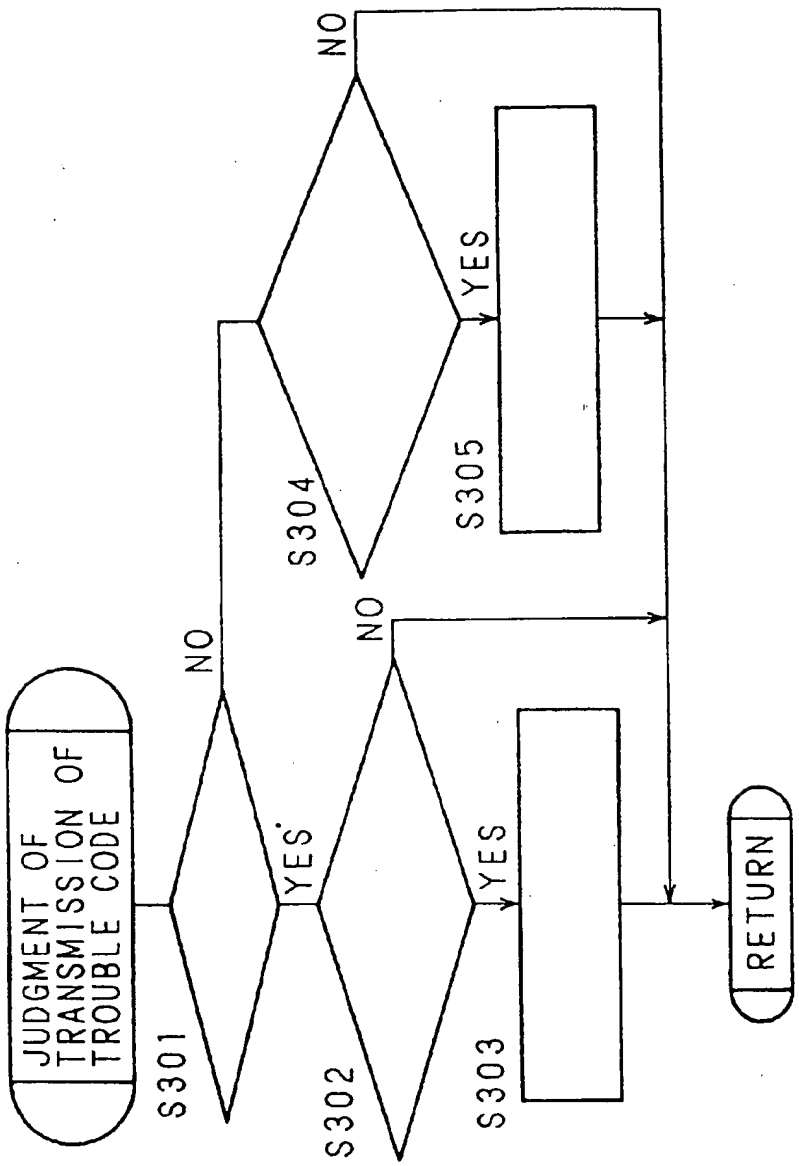

JUDGMENT OF TRANSMISSION OF TROUBLE CODE
S301
NO
YES
S302
NO
YES
S303
S304
NO
YES
S305
RETURN

Fig. 10

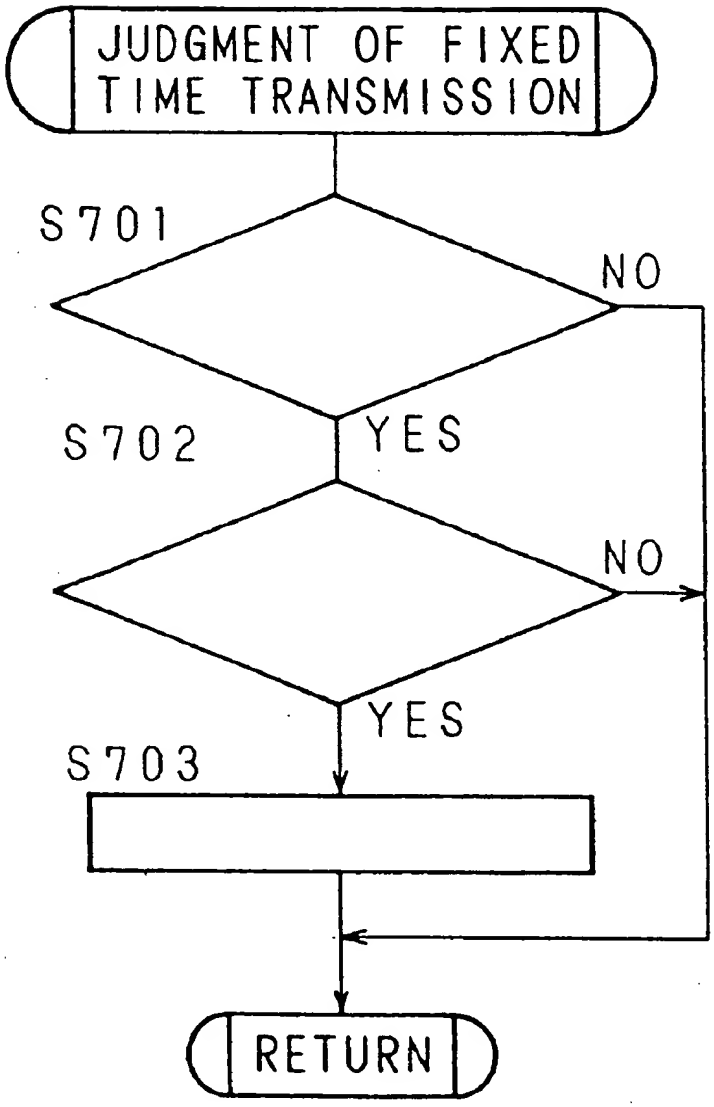

JUDGMENT OF FIXED TIME TRANSMISSION
S701
NO
YES
S702
NO
YES
S703
RETURN

Fig. 11

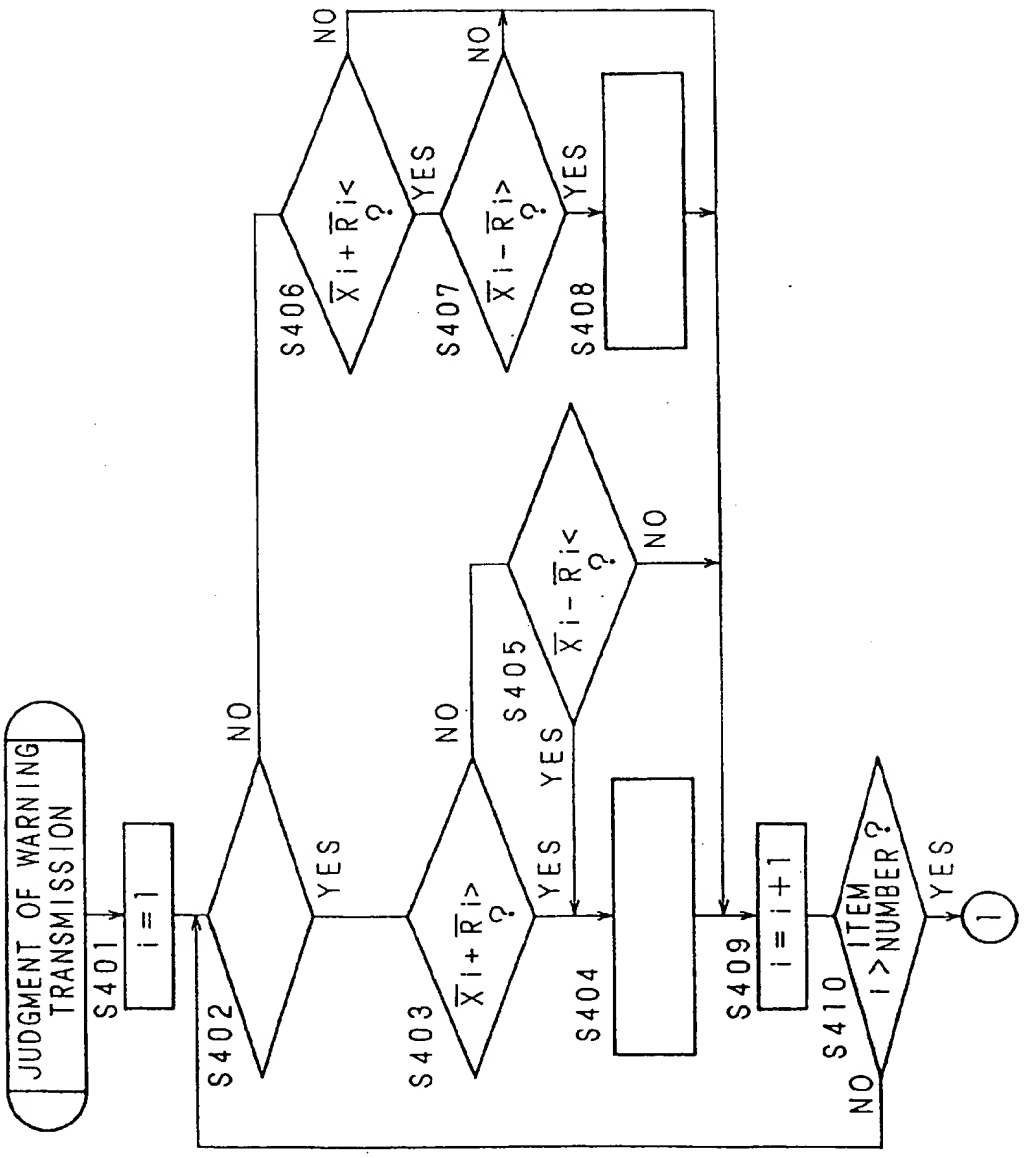

JUDGMENT OF WARNING TRANSMISSION
S401
i = 1
S402
NO
YES
S403
NO
YES
S404
S405
NO
YES
S406
NO
YES
S407
NO
YES
S408
S409
i = i + 1
S410
ITEM i > NUMBER ?
NO
YES
1

Fig. 12(a)

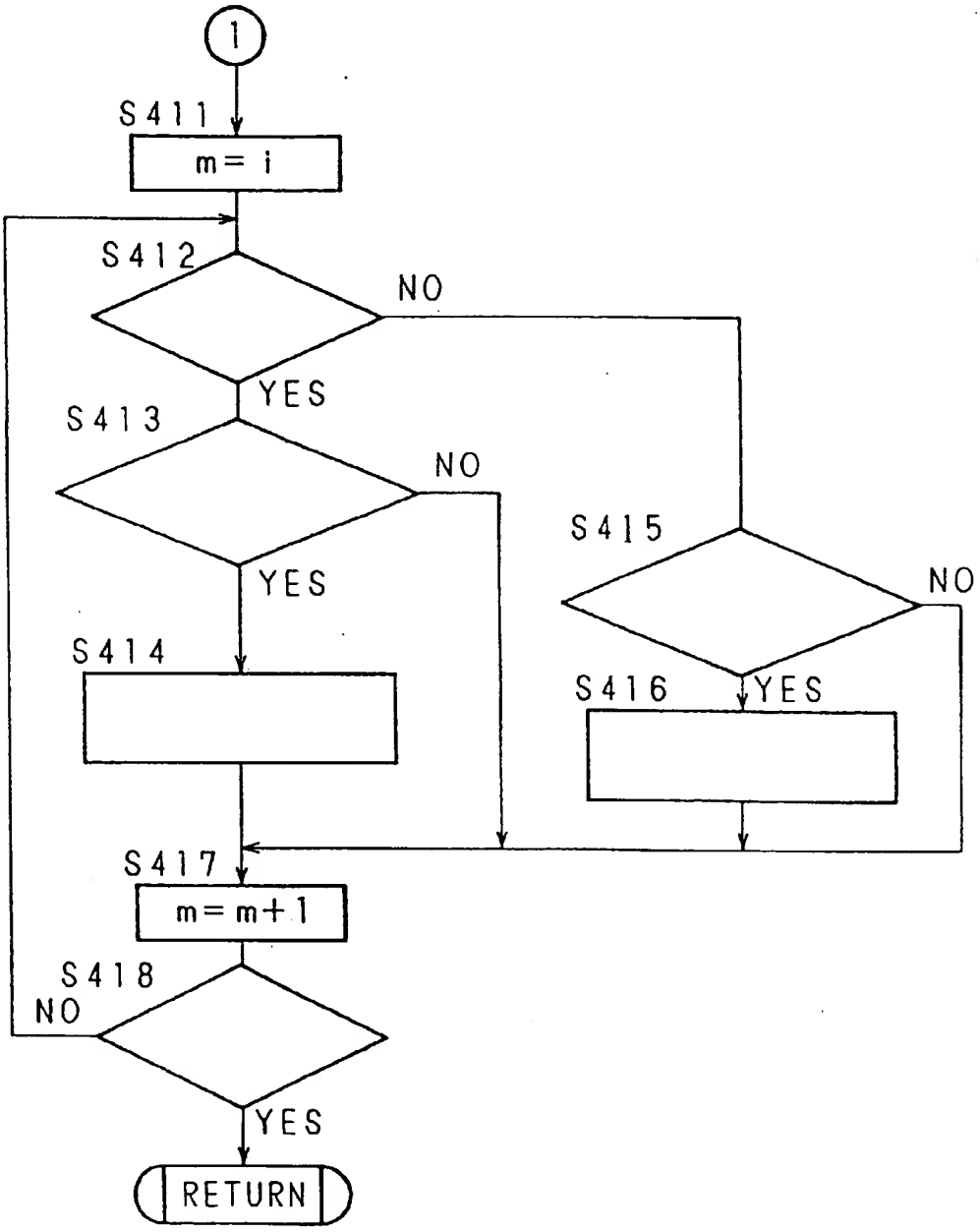

1
S411
m = i
S412
NO
YES
S413
NO
YES
S414
S415
NO
S416
YES
S417
m = m+1
S418
NO
YES
RETURN

Fig. 12(b)

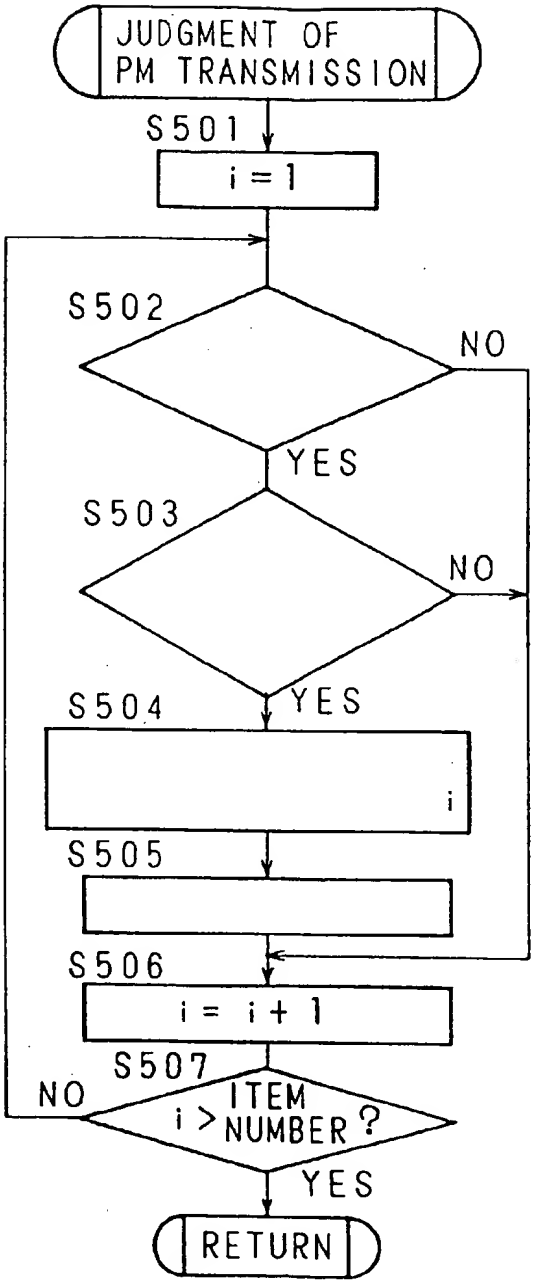
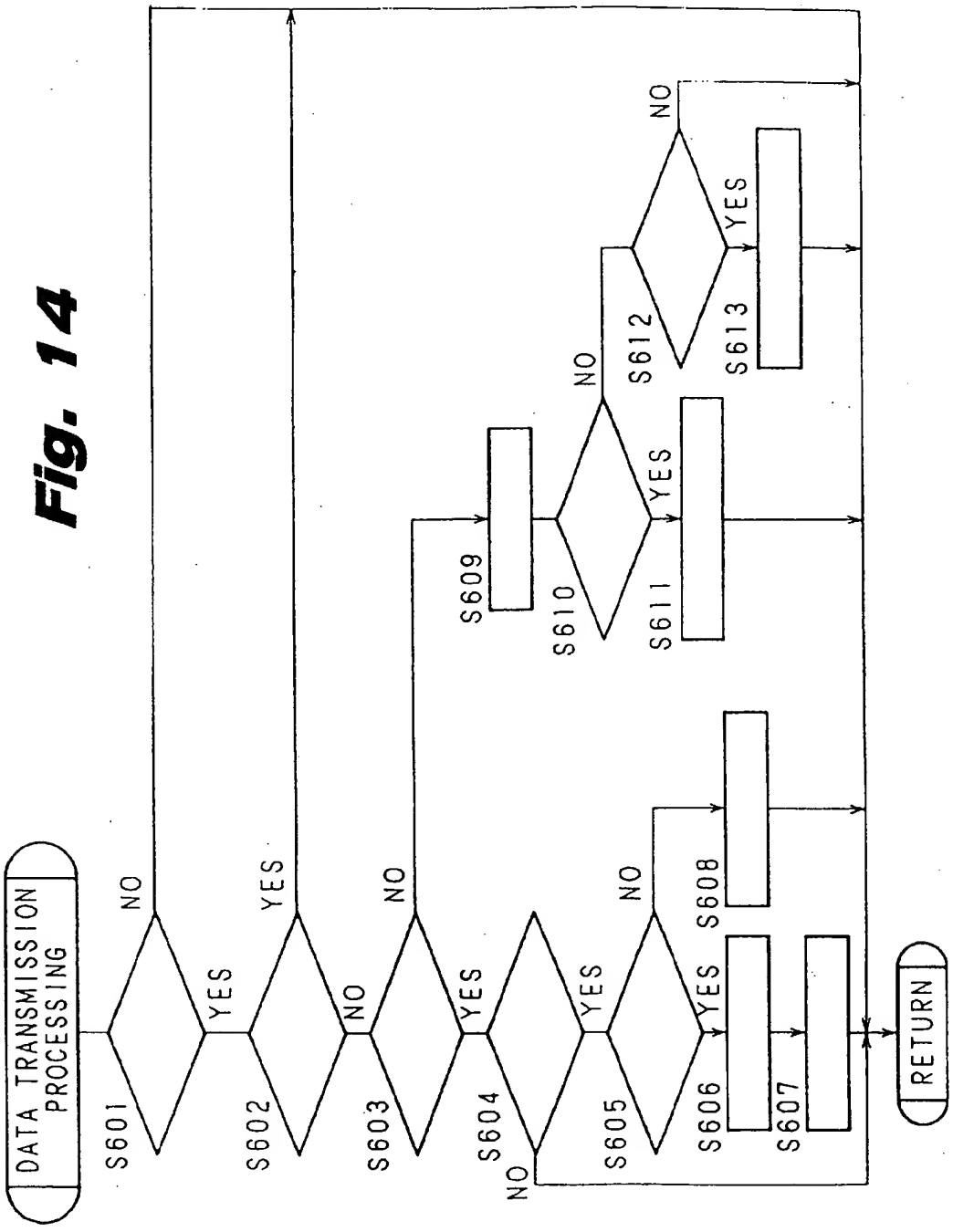

JUDGMENT OF PM TRANSMISSION
S501
i = 1
S502
NO
YES
S503
NO
YES
S504
i
S505
S506
i = i + 1
S507
NO
ITEM i > NUMBER ?
YES
RETURN

Fig. 13

Fig. 14


DATA TRANSMISSION PROCESSING
S601
NO
YES
S602
YES
NO
S603
NO
YES
S604
NO
YES
S605
NO
YES
S606
S607
S608
S609
S610
NO
YES
S611
S612
NO
YES
S613
RETURN

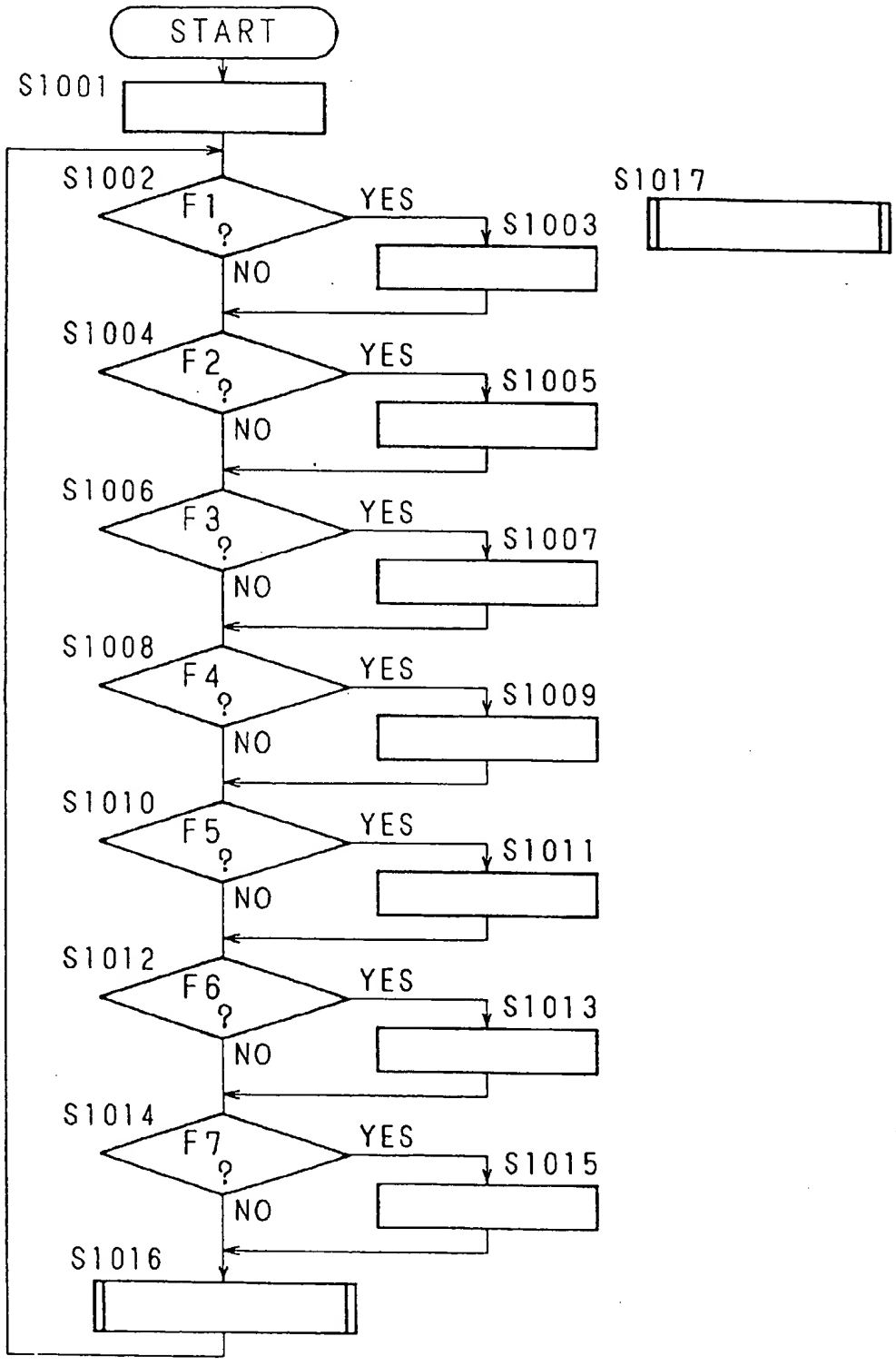

START
S1001
S1002
F1 ?
YES
S1003
NO
S1004
F2 ?
YES
S1005
NO
S1006
F3 ?
YES
S1007
NO
S1008
F4 ?
YES
S1009
NO
S1010
F5 ?
YES
S1011
NO
S1012
F6 ?
YES
S1013
NO
S1014
F7 ?
YES
S1015
NO
S1016
S1017

Fig. 15

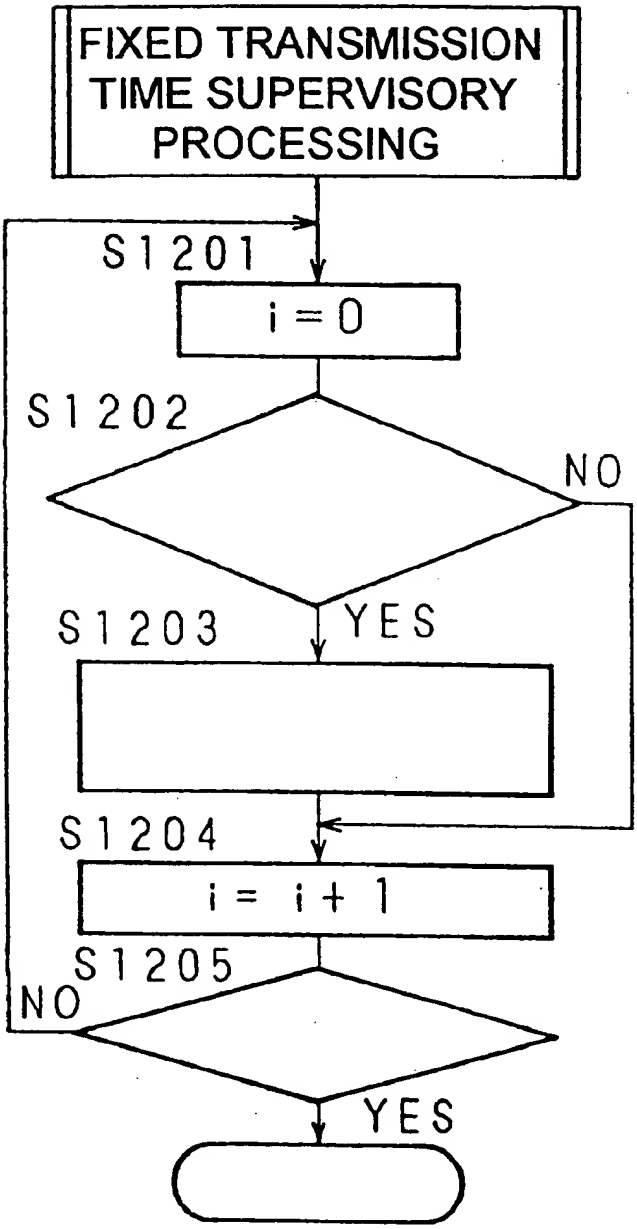

FIXED TRANSMISSION TIME SUPERVISORY PROCESSING
S1201
i = 0
S1202
NO
S1203
YES
S1204
i = i + 1
S1205
NO
YES

Fig. 16

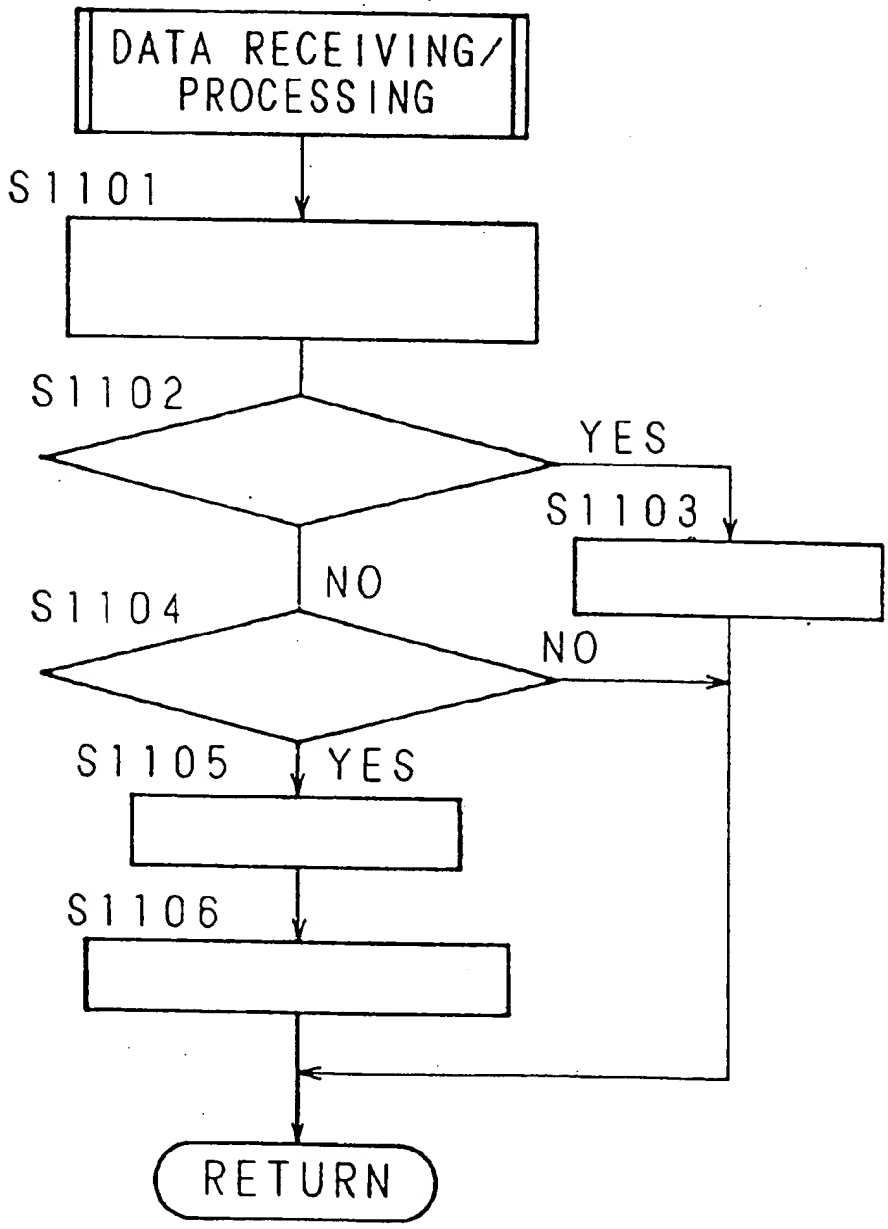

DATA RECEIVING/ PROCESSING
S1101
S1102
YES
S1103
NO
S1104
NO
S1105
YES
S1106
RETURN

Fig. 17

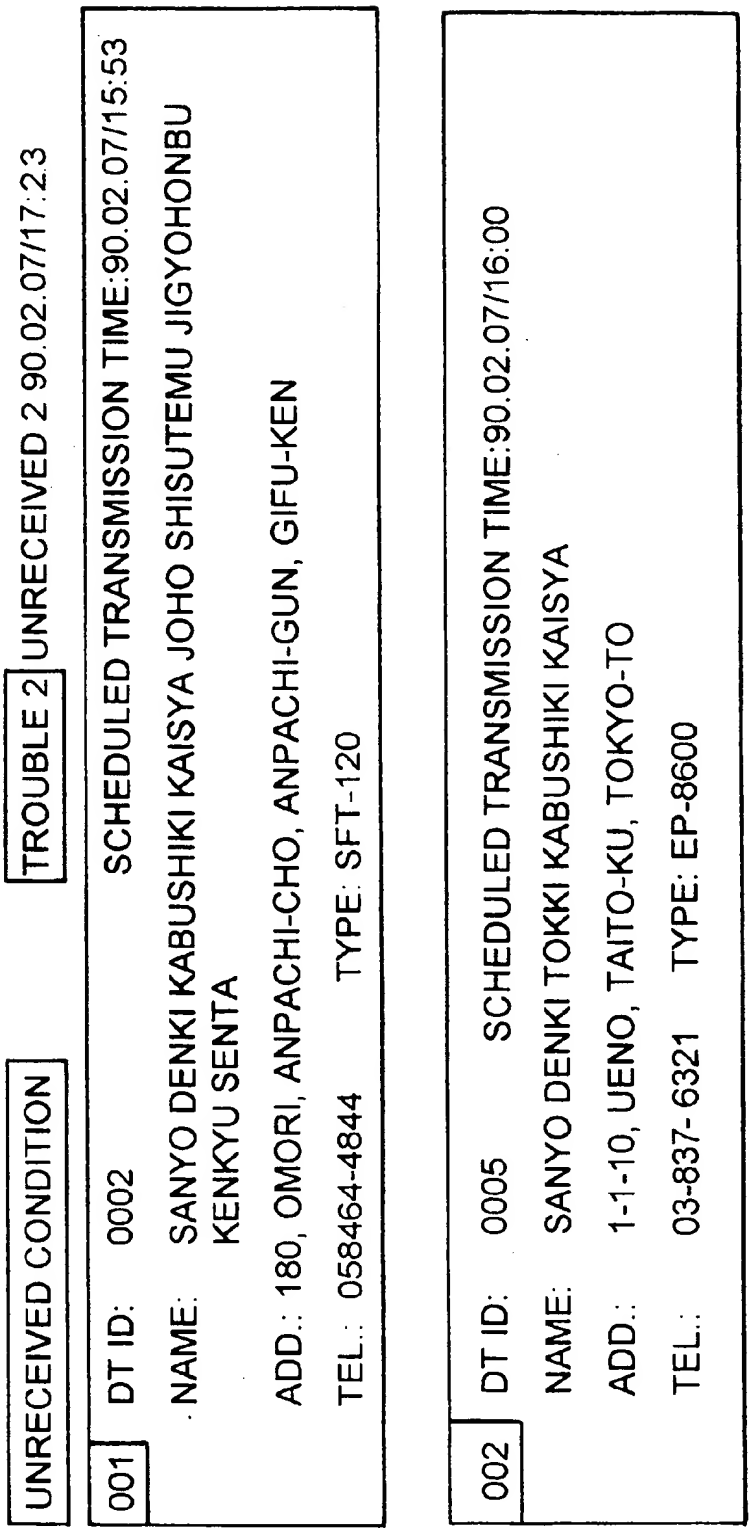

UNRECEIVED CONDITION
TROUBLE 2 UNRECEIVED 2 90.02.07/17:23
001 DT ID: 0002 SCHEDULED TRANSMISSION TIME:90.02.07/15:53
NAME: SANYO DENKI KABUSHIKI KAISYA JOHO SHISUTEMU JIGYOHONBU KENKYU SENTA
ADD.: 180, OMORI, ANPACHI-CHO, ANPACHI-GUN, GIFU-KEN
TEL.: 058464-4844 TYPE: SFT-120
002 DT ID: 0005 SCHEDULED TRANSMISSION TIME:90.02.07/16:00
NAME: SANYO DENKI TOKKI KABUSHIKI KAISYA
ADD.: 1-1-10, UENO, TAITO-KU, TOKYO-TO
TEL.: 03-837- 6321 TYPE: EP-8600

Fig. 18

CENTRALIZED CONTROL SYSTEM FOR TERMINAL DEVICE

This is a continuation of application Ser. No. 8/203,684, filed Feb. 28, 1994, now U.S. Pat. No. 5,631,724, which was a continuation of Ser. No. 07/905,065 filed Jun. 24, 1992, now abandoned, which was a continuation of Ser. No. 07/682,511 filed Apr. 8, 1991, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a centralized control system for terminal devices capable of controlling an image forming apparatus such as a copying machine, facsimile, and laser beam printer, and further a terminal devices such as automatic vendor with the use of communication lines from a remote place.

2. Description of the Related Art

An image forming apparatus such as a copying machine requires maintenance and inspection including replacement of photoreceptors and toner so as to remain in good condition. A specialized service company is in charge of these management of the apparatus, together with management of rental fee for the apparatus. The service company sends a service person regularly or in the case where the copying machine is out of order. However, an increase in the number of copying machines with the spreading use thereof, and also an increase in the number of inspection items with the copying machine becoming more multi-function will lead to an increasing burden on the service company. In view of this, there exists a growing need for a labor-saving system capable of centrally and remotely controlling a plurality of the copying machines by a central unit.

These circumstances are similar to those for an automatic vendor, such as the one for drinks or cigarettes. A specialized vendor company is in charge of sales management and maintenance and inspection for the automatic vendor. Accordingly, there exists a growing need for a system capable of centrally and remotely controlling a plurality of automatic vendors by a central unit.

A system for management of a plurality of copying machines is disclosed in U.S. Pat. No. 4,583,834. In the disclosed system, various operating data of the copying machine such as a total number of copies, machine malfunctions and amounts of remaining copy sheets and toner transmitted to a computer through a communication network. The computer processes the transmitted data and feeds back to the copying machine instructions.

A centralized control system in which data of copying machines are transmitted from respective data terminal devices to a central unit through a communication network is proposed by the inventors. In this proposed system, communication between each data terminal device and the central unit is achieved at a fixed transmission time.

Nevertheless, in the proposed centralized control system as described above, in the case where the central unit is unable to receive the information at the fixed transmission time due to abnormality in the data terminal device, abnormality in connection of the communication line or the like, the central unit is incapable of confirming that it has been unable to receive the information. As a result, such a problem will arise that the abnormality in the data terminal device or in the connection of the communication line cannot be detected at an early stage.

Further, in the case where the proposed centralized control system as described above is adopted for controlling the copying machine, the following problem may arise. Since the power supply for the data terminal device is generally fed from the copying machine, in the case where the power supply for the data terminal device is shut off because the copying machine is not in use at the fixed transmission time, the data terminal device cannot transmit the data at the fixed transmission time.

Especially, in recent years, in the case where copying operations are not executed over a predetermined period of time, most types of copying machines have the power supply thereof automatically shut off to save the power. Accordingly, there is a likelihood that the above problem may frequently arise. These circumstances are also similar to those for the automatic vendor. Especially, since nighttime sales of alcoholic beverages by the use of the automatic vendor is frequently regulated by an ordinance, the power supply for the automatic vendor is often shut off at night.

Accordingly, in the proposed centralized control system, in the case where the information to be transmitted at the fixed transmission time is not transmitted to the central unit, the central unit cannot collect the necessary data with certainty. As a result, such a problem may arise that the controlling function of the central unit may not be fully utilized.

SUMMARY OF THE INVENTION

The present invention has overcome the above drawbacks and has an object of providing a centralized control system for terminal device, which is capable of detecting an abnormality in communicating means provided for each terminal device or in a communication line at an early stage since, when there exists a terminal device which has not transmitted information to a central unit when past the fixed transmission time, the information specifying the terminal device is displayed, thereby enabling identification of the terminal device not having executed its fixed time transmission.

It is another object of the present invention to provide a centralized control system for terminal device in which power supply for a memory disposed at the data terminal device and an IC for clocking the present time is backed up so as to store the information to be transmitted at the fixed transmission time. Accordingly, even in the case where the fixed time transmission has been unable to be executed because the power supply for the terminal device is shut off at the transmission time, when the power is supplied again, the stored information to be transmitted at the fixed transmission time is transmitted with certainty by comparing the backed up present time with the transmission time. Thereby, controlling function of the central unit becomes reinforced.

It is further another object of the present invention to provide a centralized control system for an image forming apparatus in which it is determined that the image forming apparatus has recovered from a trouble condition, such as jamming, to a normal condition by judging whether a sheet of paper is actually discharged from the apparatus, thus preventing trouble recovery transmission from being unnecessarily executed repeatedly for the same trouble.

The centralized control system for terminal device according to the present, invention, has one or more terminal devices, communicating means provided for each terminal device for transmitting each information relating to operational condition of each terminal device at a predetermined time, control means connected to each communicating means through a communication line and adopted for controlling each terminal device in accordance with the information transmitted from each terminal device, wherein the

control means comprises supervising means for supervising the information transmission by each communicating means at the predetermined time, detecting means for detecting the communicating means not executing the information transmission at the predetermined time as a result of supervisory, and displaying means for displaying the information identifying the communicating means detected by the detecting means.

With the above construction, the information transmission from each communicating means at the fixed transmission time is normally supervised by the control means. As a result, when the communicating means not executing the information transmission even past the fixed transmission time is detected, the identification information of the very communicating means is displayed. Accordingly, abnormality in the communicating means provided for each terminal device or in connection of the communication line can be detected at an early stage.

Further, the centralized control device according to the present invention has one or more terminal devices, communicating means provided for each terminal device for transmitting each information relating to operational condition of each terminal device when the power is supplied, control means connected to each communicating means through the communication line for controlling the terminal device in accordance with the information transmitted from each communicating means, wherein the communicating means comprises storing means for storing the information, holding means for holding the information at the predetermined time, clocking means for clocking the present time, a back-up power source for backing up the storing means and the time clocking means when the power supply is shut off, transmitting means for, in the case where the information cannot be transmitted since the power supply is shut off at the predetermined time, transmitting information to be transmitted at the predetermined time, which is stored in the storing means, when the power is supplied again in accordance with the present time clocked by the clocking means and the data held by the holding means at the predetermined time.

With the above construction, in the case where the power supply for the terminal device is shut off, the data to be transmitted at the predetermined time is held rather than erased. Further, in the case where the power supply is shut off at the predetermined time, the present time and the predetermined time are compared with each other at the time when the power is supplied again. In the case where tie predetermined time has already passed, the information which should have been transmitted at the predetermined time is transmitted to the control means.

Moreover, the centralized control system for the image forming apparatus according to the present invention has one or more image forming apparatuses for forming an image on a paper, communicating means provided for each image forming apparatus for transmitting information relating to operational condition of the image forming apparatus, such as trouble information, control means for controlling the image forming apparatus in accordance with the information transmitted from the communicating means, wherein the communicating means comprises a first judging means for judging the trouble condition of the image forming apparatus in accordance with the trouble information, a second judging means for judging whether the paper is discharged from the image forming apparatus, and a third judging means for judging that the image forming apparatus has recorded from the trouble condition to the normal condition in accordance with judgment results by the first and second judging means.

With the above construction, in the case where the image forming apparatus is in trouble condition, the first judging means determines that the image forming apparatus is in trouble condition in accordance with the trouble information. In addition, in the case where it is determined that the image forming apparatus is in trouble condition by the first judging means, when the second judging means determines that the paper is discharged from the image forming apparatus, the third judging means determines that the image forming apparatus has recovered from the trouble condition to the normal condition.

The above and further objects and features of the invention will more fully by apparent from the following detailed description with accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram showing an explanatory system configuration of an entire centralized control system for terminal device according to the present invention;

FIG. **2** is a block diagram showing an explanatory construction of a central unit of the centralized control system for terminal device;

FIG. **3** is a block diagram showing an explanatory construction of a data terminal device;

FIG. **4** is a diagram showing an explanatory configuration of an operation unit of the data terminal device;

FIG. **5** is a diagram showing an explanatory configuration of a control panel;

FIG. **6** is a flow chart showing operational procedure in a main routine of the data terminal device;

FIG. **7** comprising FIGS. **7**(*a*) through **7**(*e*), is a diagram showing an example of configuration of count data,

FIG. **8** comprising FIGS. **8**(*a*) and **8**(*b*) is a flow chart showing procedure in an initialization processing routine of the data terminal device;

FIG. **9** comprising FIGS. **9**(*a*) through **9**(*c*) is a flow chart showing procedure in an element data receiving/data processing routine in the data terminal device;

FIG. **10** is a flow chart showing procedure in a trouble transmission judging processing routine of the data terminal device;

FIG. **11** is a flow chart showing contents of a fixed time transmission judging processing routine of the data terminal device;

FIG. **12** comprising FIGS. **12**(*a*) and **12**(*b*), is a flow chart showing procedure in a warring transmission judging processing routine of the data terminal device;

FIG. **13** is a flow chart showing procedure in a PM transmission judging processing routine of the data terminal device;

FIG. **14** is a flow chart showing procedure in a data transmission processing routine of the data terminal device;

FIG. **15** is a flow chart showing operational procedure in a main routine of a central unit;

FIG. **16** is a flow chart showing procedure in a fixed time transmission supervisory processing routine of the center system;

FIG. **17** is a flow chart showing procedure in a data receiving/processing routine; and

FIG. **18** is a diagram showing an example of a display screen displaying unreceived conditions.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, the present invention will be described with reference to drawings showing the embodiments thereof.

FIG. 1 is a diagram showing an explanatory system configuration of an entire centralized control system for terminal device according to the present invention. FIG. 2 is a block diagram showing an explanatory construction of a central unit of the centralized control system.

In the present embodiment, a copying machine which is an image forming apparatus is employed as a terminal device in a system configuration.

Each of a plurality of copying machines 1 are provided with a data terminal device 2 as modem integrated communicating means. Each of the copying machines 1 are adopted for transmitting data to the data terminal device 2 through a first serial interface (hereinafter referred to as I/F) 11 and a second serial I/F 12 to be described below (see FIG. 3). Also, on top surface of each of the copying machine 1 is disposed a control panel 100 adopted for instructing a copying operation or the like.

The data terminal device 2 collects data including operational condition of the copying machine 1 and transmits the data to centralized control means, or a central unit 3 through communication line 6. In addition, the data terminal device 2 comprises an operation unit 20 for performing operations, such as initializing a mode.

The central unit 3 comprises a monitor 31, a centralized processing unit 32, a keyboard 33, a storing unit 34, a modem 35, and a printer 36. In the central unit 3 are performed the following operations. First, data received through the communication line 6 is inputted through the modem 35 to the centralized processing unit 32, which is a personal computer in this embodiment. After being processed in the centralized processing unit 32, the specified data is automatically or manually by the use of keyboard 33 outputted to the monitor 31 or the printer 36. In this embodiment, a CRT display is used as a monitor. The centralized processing unit 32 is connected to the storing unit 34 including an auxiliary memory, such as a ROM, RAM, or hard disk. In the storing unit 34 are stored a program for the centralized processing unit 32 and data to be processed therein.

FIG. 3 is a block diagram showing an explanatory construction of the data terminal device 2.

The data terminal device 2 has a CPU 200 actuatable when a power source 29 is mounted thereto and executable various data processings. The power source 29 is commonly used by the copying machine 1 and turned on or off by a switch, not shown.

Various data transmitted through the first and second serial I/Fs 11 and 12 of the copying machine 1 is given to the CPU 200 through a first serial I/F 21 and a second serial I/F 22 on the data terminal device 2 side. The first serial I/Fs 11, 21 deal with data, such as information relating to set mode and operational condition of the copying machine 1, and various count data. On the other hand, the second serial I/Fs 12, 22 deal with element data, such as image forming conditions including voltages applied for developing bias and exposure.

The count data and element data read into the CPU 200 through the first serial I/Fs 11, 21 and the second serial I/Fs 12, 22 are stored in a static RAM (hereinafter referred to as SRAM) 24. Also, initialization data including telephone number and identification number (hereinafter referred to as ID number) of the central unit 3 and ID number of the data terminal device 2 are stored in the SRAM 24 at the time of initialization by the use of the operation unit 20 and the control panel 100. Further, the SRAM 24 is, together with a timer IC 25, backed up by a back-up power source 27, and various stored data remains to be stored therein without volatiling even when the power supply is shut off.

FIG. 4 is a diagram showing an explanatory configuration of the operation unit 20 of the data terminal device 2.

On the front surface of the data terminal device 2 is disposed four dip switches, DS1, DS2, DS3, DS4, and a push switch PS. The dip switch DS4 is a switch for entering an initialization mode, and the dip switches, DS1, DS2, DS3, are switches for designating respectively set modes of the telephone number and ID number of the central unit 3, and of the ID number of the data terminal device 2. The push switch PS is a switch for manually transmitting the data. These switches, PS, DS1, DS2, DS3, DS4 are connected to the CPU 200.

In the time of setting each mode, numerical values are inputted with the use of the control panel 100 disposed on the copying machine 1.

FIG. 5 is a diagram showing an explanatory configuration of the control panel 100.

On the control panel 100 are disposed a display unit 101 for displaying a two-digit numerical value by 7 segment display, a ten key 102 for inputting numerical values, a clear key 103 and a print key 104.

Also, the CPU 200 has a first LED L1 and a second LED L2 connected thereto. The first LED L1 is lighted on when the data terminal device 2 is initialized, and lighted on and off when initialization of the data terminal device 2 is properly completed. However, when the initialization of the data terminal device 2 is not properly completed, the first LED L1 is not lighted on. The second LED L2 is lighted on when the data terminal device 2 and the central unit 3 communicate with each other. The second LED L2 is lighted on and off when the communication between the data terminal device 2 and the central unit 3 is properly completed, and lighted off when the communication is not properly completed.

Various data stored in the SRAM 24 are transmitted through an RS-232C I/F 26 to the communication line 6 by a modem 28, and read into the central unit 3 through the modem 35 thereof.

Next, there will be described operation of the centralized control system for terminal device, according to the present invention, constructed in such a manner as described above.

FIG. 6 is a flow chart of operation procedure in the main routine of the data terminal device 2.

Before the flow chart shown in FIG. 6 is described, there will be explained definitions of terms, "on edge" and "off edge" used in explaining each flow chart hereinafter.

"On-edge" is referred to such a change of state that state of switches, sensors, signals or the like are turned from off to on.

"Off-edge" is referred to such a change of state that state of switches, sensors, signals or the like are turned from on to off.

When the power is supplied, the data terminal device 2 first judges whether the initialization mode is set depending on whether the dip switch DS5 is in ON or OFF state in Step S1. In the case where the dip switch DS4 is in ON state, the data terminal device 2 enters under the initialization mode to implement initialization in Step S2. On the other hand, in the case where the dip switch DS4 is in OFF state, that is, either in the case where initialization mode is not set, or is completed, the data terminal device 2 sends a copying operation enable signal through the first serial I/Fs 21, 11 to the copying machine 1 so as to permit the copying machine 1 to perform copying operation in Step S3.

Upon receiving the copying operation enable signal, the copying machine **1** transmits count data each time completing one cycle of the copying operation. The data terminal device **2** receives the count data transmitted through the first serial I/Fs **11**, **21** from the copying machine **1** in Step S4. Contents of the count data include a discharge code, JAM trouble code, JAM trouble counter, counters provided for each size of copy paper, and counters used by respective parts (hereinafter referred to as PM counter) of the copying machine **1**. The data terminal device **2** renews the value into an updated one and holds the renewed value each time receiving these count data.

FIG. **7** is a diagram showing an example of configuration of the count data.

The discharge code **71** is data of 1 byte (8 bits) indicating that a sheet of copy paper is discharged from the copying machine **1**. The discharging of the copy paper is indicated by the fall of the least significant bit b_0.

The JAM trouble code **72** is data of 1 byte indicating condition of the copying machine **1**. The most significant bit b_7=0 indicates that the copying machine **1** is in normal condition. Also, the most significant bit b_7=1 and a bit b_6=0 indicate that the copying machine **1** is in a jamming (JAM) condition. Further, the most significant bit b_6=1 indicate that the copying machine **1** is in trouble condition. In this case, the cause of the JAM trouble is indicated by bits b_5 through b_0.

The JAM trouble counter **73** indicates a count value in 16 bits every item, or cause of trouble. Similarly, the counters **74** provided for each size of copy paper and the PM counter **75** indicate count values in 24 bits every item, or copy paper size and part respectively.

Upon receiving the count data, the data terminal device **2** receives the element data transmitted through the second serial I/Fs **12**, **22** each time a sheet of copy paper is discharged from the copying machine **1**. The data terminal device **2** applies data processings to the received element data to be described below in Step S5. The element data are representative of image forming conditions, such as voltages applied for developing bias and exposure as described above. These element data are indicated in numerical values of 8 bits (256 levels).

Next, the data terminal device **2** judges whether a trouble code has been transmitted in according with the trouble flag set depending on the state of JAM trouble code **72** in Step S6. Subsequently, the data terminal device **2** judges whether data has been transmitted at fixed transmission time in accordance with a fixed time transmission flag set by the central unit **3** and indicative of whether the fixed transmission time has already passed in Step S7.

Next, the data terminal device **2** judges whether a warning has been transmitted depending on the state of a warning transmission flag set in the case where the element data exceeds either an upper or lower limit threshold, or in the case where the JAM trouble counter **73** or PM counter exceeds count thresholds in Step S8. Subsequently, the data terminal device **2** judges whether the data is manually transmitted in Step S9.

The manual transmission judgment is executed in accordance with a manual transmission flag set by actuating at a normal time the push switch PS used in the case where the initialization transmission is executed at the time of initialization. The transmitted data is same as the data transmitted in the time of the trouble transmission and the warning transmission.

Further, the data terminal device **2** executes PM code transmission judgment in accordance with the PM transmission flag set in the case where certain part is replaced because the PM counter **75** has reached the count threshold in Step S10. Consequently, the data terminal device **2** transmits the necessary data through the modems **28** and **35** to the central unit **3** in accordance with the above judgment results in Step S11.

Next, there will be described each processing routine.

FIG. **8** is a flow chart showing procedure of an initialization processing routine of the data terminal device **2**.

First, SRAM **24** is initialized in Step S100, and on-edge of the dip switch DS1 is judged in Step S101. When the on-edge of the dip switch DS1 is detected, this routine enters a telephone number input mode under which the telephone number of the central unit **3** is inputted.

Under the telephone number input mode, the on-edge of the print key **104** is judged in Step S102. In the case where the on-edge of the print key **104** is detected, the first-ranked number out of numbers inputted through the use of the ten key **102** and displayed on the display unit **101** is read into and registered as a telephone number of the central unit **3** in Step S103. These Steps S102 and S103 are repeated by the number of inputted telephone numbers. Upon detecting the off-edge of the dip switch DS1 in Step **104**, the telephone number input mode ends.

On the other hand, in the case where the on-edge of the dip switch DS1 is not detected in Step S101, this routine proceeds to Step S105 in which the on-edge of the dip switch DS2 is judged. In the case where the on-edge of the dip switch DS2 is detected, the on-edge of the print key **104** is judged in Step S106. In the case where the on-edge of the print key **104** is detected, the first-ranked number out of numbers inputted through the use of the ten key **102** and displayed on the display unit **101** is read into the registered as an ID number of the central unit **3** in Step S107. These Steps S106 and S107 are repeated by the number of the inputted numbers. Consequently, the ID number input mode for the central unit **3** ends upon detecting the off-edge of the dip switch DS2.

On the other hand, in the case where the on-edge of the dip switch DS2 is not detected in Step S105, this routine proceeds to Step S109 in which the on-edge of the dip switch DS3 is judged. In the case where the on-edge of the dip switch DS3 is detected, the on-edge of the print key **104** is judged in Step S110. In the case where the on-edge of the print key **104** is detected, the first-ranked number out of numbers inputted through the use of the ten key **102** and displayed on the display unit **101** is read into and registered as an ID number for the data terminal device **2** in Step **111**. These Steps S110 and S111 are repeated by the number of the inputted numbers. Consequently, the ID number input mode for the data terminal device **2** ends upon detecting the off-edge of the dip switch DS3 in Step **112**.

Upon completion of each mode, it is judged whether mode setting is completed depending upon whether the data is inputted under each mode in Step **113**. In the case where the mode setting has not been completed yet, this routine returns to S101. On the contrary, in the case where the mode setting has been completed, the on-edge of the push switch PS is detected in Step **114**. Synchronized with the timing of detection of the on-edge of the push switch PS, initialization data is transmitted the central unit **3** through the modems **28** and **35**. In addition, in the data terminal device **2** are received a closing date, fixed transmission time and various thresholds used for warning judgment preset in the central unit **3** to total the count data in Step S115.

Consequently, when it is determined that communication between the data terminal device **2** and the central unit **3** has

been normally completed in Step S116, the initialization processing routine returns to the main routine. When the communication between the data terminal device 2 and the central unit 3 is not normally completed due to the fact that the central unit 3 is engaged or that communication trouble has arisen, the initialization processing routine recycles to Step S101 and waits for the on-edge of the push switch PS again in Step 114.

FIG. 9 is a flow chart showing procedure of the element data receiving/data processing routine executed in Step 5.

First, in step S201, the element data x_{ij} (i: data number) of 8 bits transmitted through the second serial I/Fs 12 and 22 is read in each time at a sheet of copy paper is discharged from the copying machine 1. Next, the data number i is set to 1 in Step S202. Then, it is judged whether X_{ij} is greater than the maximum element data X_{iMAX} in Step S203. In the case where the X_{ij} is greater than X_{iMAX}, then the X_{ij} is set to be the maximum element data in Step S204. In the case where the X_{ij} is not greater than the X_{iMAX}, this routine proceeds to S205 in which it is judged whether the X_{ij} is smaller than the minimum element data x_{iMIN}. In the case where the X_{ij} is smaller than the X_{iMIN}, the X_{ij} is set to be the minimum element data X_{iMIN} in Step 206. Then, in Step S207, the added value is obtained by adding the X_{ij} to the X_{ik}. Subsequently, the data number i is incremented one in Step S208, and it is judged whether the data number i is greater than the item number in Step 209. In the case where the data number i is not greater than the item number, this routine returns to step S203. In the case where the data number i is greater than the item number, this routine proceeds to Step S210 in which the number j is increased by one. Subsequently, it is judged whether the number j is greater than 4 in Step S211. In the case where the number j is not greater than 4, this routine recycles to Step S203. On the contrary, in the case where the number j is greater than 4, this routine proceeds to Step S212. In the above procedure, four of each maximum element data X_{iMAX}, minimum element data X_{iMIN}, added value are obtained for each item.

In Steps S212 and S213, the number j and the data number i are respectively set to 1. Then, in Step S214, a range R_{ik} is obtained by using the following equation;

$$R_{ik}=X_{iMAX}-X_{iMIN},$$

and a mean X_{ik} is obtained by using the following equations;

$$X_{ik}=X_{ik}/4.$$

Subsequently, the maximum element data X_{iMAX} and the minimum element data X_{iMIN} are respectively set to 0 and 255 in Step S215, and the data number i is incremented by 1 in Step S216. Then, it is judged whether the data number i is greater than the item number in Step S217. Thereby, the range R_{ik} and the mean X_{ik} are obtained for all the items.

Then, in Step S218, it is judged whether the number k is greater than 32. In the case where the number k is not greater than 32, this routine proceeds to Step S228 in which the data number i is set to 1. Thereafter, the sums of X_{ik} and R_{ik} are obtained in Step S229 by using the following equations respectively;

$$X_{iSUM}=X_{iSUM}+X_{ik}, \text{ and}$$

$$R_{iSUM}=R_{iSUM}+R_{ik}.$$

Then, the data number i is incremented by 1 in Step S230 and it is judged whether the data number i is greater than the item number. In the case where the data number i is not greater than the item number, this routine returns to Step S229. On the contrary, in the case where the data number i is greater than the item number, the number k is incremented by 1 in Step S232. Consequently, this routine returns.

On the other hand, in the case where the number k is greater than 32in Step S218, this routine proceeds to Step S219 in which the data number i is set to 1. Then, in Step S220, the sums of X_{ik} and R_{ik} are obtained respectively by using the following equations;

$$X_{iSUM}=X_{iSUM}+X_{i33}-X_{i1}, \text{ and}$$

$$R_{iSUM}=R_{iSUM}+R_{i33}-R_{i1}$$

and a mean X_i of 32 element data axid a mean $\overline{R}_i$ of 32 range are obtained respectively by using the following equations;

$$\overline{X}_i=X_{iSUM}/32, \text{ and}$$

$$\overline{R}_i=R_{iSUM}/3.$$

Subsequently, the number l is set to 1 in Step S221 and, in Step S222, X_{il} and R_{il} are set respectively to X_{il+1} and R_{il+1}. Then, the number l is incremented by 1 in Step S223 and it is judged whether the number l is greater than 32 in Step S224. In the case where the number l is not greater than 32, this routine returns to Step S222. On the contrary, in the case where the number l is greater than 32 in Step S224, X_{i33} is set to 0 in Step S225. Then, the data number i is incremented by 1 in Step S226. Consequently, it is judged whether the data number i is greater than the item number. In the case where the data number i is greater than the item number, the element data receiving/data processing routine returns to the main routine.

Since element data used to obtain the means $\overline{X}_i$ and $\overline{R}_i$ are latest received 32 X_{ik} and 32 R_{ik}, the oldest element data X_{il} and R_{il} are discarded and the remaining element data are sequentially forwarded by 1 each time the new X_{i33} and R_{i33} are transmitted. The means $\overline{X}_i$ and $\overline{R}_i$ are calculated for all the items. In other word, the means X_{ik} and the range R_{ik} are obtained each time four cycles of copying operation are completed for each kind of element data. Each time 32 mean values of each of X_{ik} and R_{ik} are obtained, that is, each time 128 cycles of copying operation are completed, the mean values $\overline{X}_i$ and $\overline{R}_i$ are obtained. Thereafter, each time four cycles of copying operation are comnpieted, new mean value X_{ik} and mean range R_{ik} are calculated with the use of a moving ave rage method.

Further, when the SRAM 24 is initialized in Step S100 of the initialization processing routine, X_{iMAX}, X_{iMIN}, X_{iSUM}, Rl_{iSUM}, X_{ik}, R_{ik}, j, k are set to 0, 255, 0, 0, 0, 0, 1, 1, respectively.

FIG. 10 is a flow chart showing procedure of the trouble transmission judgment processing routine executed in Step S6.

First, it i s judged whether a trouble flag is set to 0 in Step S301. In the case where the trouble flange is set to 0, the on-edge of a bit b_6 of the JAM trouble code 72 is judged in step 302. In the case where the on-edge of the bit b_6 of the JAM trouble code 72 is detected, it means that some sort of trouble has arisen, the trouble flag and the trouble transmission flag are both set to 1 in Step S303.

In the case where the troub le flag is set to 0, it means that the copying machine is in normal condition. On the other hand, in the case where the trouble flag is set to 1, it means that the copying machine 1 is in troubled state. In the case where the trouble transmission flag is set to 1, the copying machine is in a state which should be reported to the central unit 3 by transmitting the data.

In the case where the trouble flag is already set to 1 in Step S301, i.e., the copying machine 1 is already in trouble condition in Step S301, the off-edge of bit b_6 of JAM trouble code 72 and of the least significant bit b_0 of the discharge code 71 are judged in Step S304. Thereby, it is detected that discharging of a sheet of copy paper from the copying machine 1 is detected after a reset switch, not shown, disposed on the main body of the copying machine 1 is actuated after recovery from the trouble. When it is detected that the sheet of copy paper is discharged from the copying machine 1, the trouble flag and a trouble recovery transmission flag are set to 0 and 1 respectively in step S305, and the trouble transmission processing routine returns to the main routine. In the case where the trouble recovery transmission flag is set to 1, it should be reported to the central unit 3 by transmitting the data that the copying machine 1 has recovered from the trouble. The trouble recovery transmission flag and the trouble transmission flag are reset to 0 after the trouble code is actually transmitted to the central unit 3.

FIG. 11 is a flow chart showing contents of the fixed time transmission judgment processing routine executed in Step S7.

First, it is judged whether a fixed time transmission flag is set to 0 in Step S701. In the case where the fixed time transmission flag is set to 1, it means that the fixed transmission time has already passed the present time. In other words, the data should be transmitted to the central unit 3. Accordingly, the maximum time transmission judgment processing routine directly returns to the main routine. On the other hand, in the case where the fixed time transmission flag is set to 0, it is judged whether the fixed transmission time has already passed the present time in Step S702. In the case where already passed, the fixed time transmission flag is set to 1 in step S703, and this routine returns to the main routine.

The fixed time transmission flag is reset to 0 after the data is actually transmitted to the central unit 3. Subsequently, the central unit 3 transmits a new fixed transmission time, which is set in the data terminal device 2.

In addition, even in the case where the power supply for the data terminal device 2 is shut off at the fixed transmission time, the SRAM 24 and the timer IC 25 are in operation since being backed up by the back-up power source. Accordingly, as soon as the power is supplied to the data terminal device 2, the fixed time transmission flag is set to 1 in Step S703 in the case where the fixed transmission time has not passed yet in Step S702. Simultaneously, the data is transmitted to the central unit 3 at the fixed transmission time.

It should be noted that, in the case where the power supply for the data terminal device 2 is shut off, copying operation of the copying machine 1 is not permitted. Therefore, various counter values are not to be renewed.

FIG. 12 is a flow chart showing procedure of the warning transmission judging processing routine executed in Step 58.

In this routine, judgment of all the element data, JAM trouble counter 73 and PM counter 75.

First, the threshold of the element data is determined in Steps S401 and S410. Then the threshold of the count values are determined in Steps S411 to S418. In the case where any one of the counter values exceeds the threshold thereof, the warning transmission flag is set to 1 indicating that condition of the copying machine 1 should be reported to the central unit 32 by transmitting the data.

First, the data number i is set to 1 in step S401. Subsequently, it is judged whether the warming $flag_i$ is set to 0 in Step S402, i.e., the element data is within its characteristic tolerance (hereinafter it is referred to as normal that the element data is within its tolerance). In the case where the element data is normal, the mean value $\overline{X}_i$ and the mean range $\overline{R}_i$ are added and it is judged whether the added value $\overline{X}_i+\overline{R}_i$ is greater than the upper limit threshold $_iU$ in Step S403. In the case where the added value $\overline{X}_i+\overline{R}_i$ is not greater than the upper limit threshold $_iU$, the mean range $\overline{R}_i$ is subtracted from the mean value $\overline{X}_i$, and it is judged whether the resultant value is smaller than the lower limit threshold $_iL$ in Step S405.

In the case where the added value $\overline{X}_i+\overline{R}_i$ is greater than the upper limit threshold $_iU$ in Step S403, or in the case where the value $\overline{X}_i-\overline{R}_i$ is smaller than the lower limit threshold in Step S405, the element data is judged riot to be normal. Accordingly, the warning flag and the warning transmission flag are respectively set to 1 in Step 404. Thereafter, the data number i is incremented by 1 in Step S409, and it is judged whether the data number i is greater than the item number in Step 410. In other words, it is judged whether judgment of threshold has been completed for all the element data.

On the other hand, in the case where the result of Step 403 is not greater than the upper limit threshold $_iU$, this routine returns to Step S402 from which the sequence of Steps S402 to S410 is repeated for the subsequent element data to be determined until the data number i become greater than the item number in Step S410. Then, this routine proceeds to Step S411.

Also, in the case where the element data is judged to be normal (NO in Step) S405), the warning $flag_i$ and the warning transmission flag remain in the current states thereof and the warning transmission judging routine proceeds to Step 409.

On the other hand, in the case where the warning $flag_i$ is already set to 1 in Step 402, i.e., the element data whose data number is i is judged not to be normal, thereby a warning being given, it is judged whether the above element data has returned to its normal condition in Steps S406 and S407. Specifically, it is judged whether the added value $\overline{X}_i+\overline{R}_i$ is smaller than the upper limit threshold $_iU$ in Step S406 and greater than the lower limit threshold $_iL$ in Step S407. As a result of the above judgment, in the case where the element data has returned to its normal condition, the warning $flag_i$ is reset to 0 and the warning recovery transmission flag is set to 1 in Step 408. The above two flags are reset to 0 after the element data is actually transmitted to the central unit 3.

When judgment of threshold for all the element data are completed in Step S410, judgments of threshold for JAM trouble counter 73 and PM counter 75 are executed in the subsequent Steps. Here, a data number m is given as serial number being from the element data for convenience in Step S411. Accordingly, the minimum of data number m is equal to the item number of the element data plus 1. The maximum of the data number m is equal to a sum of the item numbers of the element data, JAM trouble counter 73, and PM counter 75.

In Step S412, it is judged whether the warning flag m is set to 0, i.e., whether the counter $value_m$ normal. In the case where the counter $value_m$ is normal, it is judged whether the counter $value_m$ exceeds the upper limit threshold $_mU$ in Step S413. In the case where the counter $value_m$ exceeds the upper limit threshold m_U, it is judged that the counter $value_m$ is not normal, and both the warning flag m and the warning transmission flag are set to 1 in Step 414, and then the data number m is incremented by 1 in Step 417.

Further, in Step S418, it is judged whether the data number m is greater than a sum of all the item number. In other words, it is judged whether judgments of threshold for

all the items of the JAM trouble counter **73** and PM counter **75** has been completed. In the case where the judgments have not been completed, the warning transmission judging routine returns to Step **S412** to repeat the sequence of Steps **S412** to **S417** until the threshold for all the items of JAM trouble counter **73** and PM counter **75** are determined. In the case where, on the other hand, all the judgments have been completed in Step **418**, this routine returns to the main routine. Also, in the case where the counter value$_m$ is not greater than the upper limit threshold $_mU$, i.e., the counter value$_m$ is normal (NO in Step **S413**), this routine proceeds directly to Step **S417** with the warning flag$_m$ and warning transmission flag remaining at their states. On the contrary, in the case where the warning flag is already set to 1 in Step **S412**, and in the case where such a warning has already been given that the counter value$_m$ is not normal, it is judged whether the count value$_m$ has returned to its normal state in Step **S415**. In the case where the count value$_m$ has returned to its normal state, the warning flag$_m$ and the warning transmission flag are set to 0 and 1 respectively in Step **S416**. The above two flags are reset to 0 after the count data is actually transmitted to the central unit **3**.

FIG. **13** is a flow chart showing procedure of the PM transmission judging processing routine executed in Step **10**.

As described above, the PM counter **75** is an enabling counter for each parts of the copying machine **1**, and is reset to 0 when a maintenance person replaces the part.

First, a counter variable i is set to 1 in Step **501** and it is judged whether the PM counter value i is set to 0 in Step **S502**. Subsequently, it is judged whether the preceding PM counter value i of the PM counter is not set to 0 in Step **S503**. In the case where the PM counter value i is set to 0 in Step **502** and the preceding PM counter value i is not set to 0 in Step **S503**, and when it is judged that the PM counter i is set to 0 this time, the preceding PM counter value i is held as a clear value i in Step **S504**. Then, the PM transmission flag is set to 1 in Step **S505**.

The PM transmission flag is reset to 0 when the counter value i and the clear value i are actually transmitted to the central unit **3**. The clear value i is provided for the purpose of holding the counter value when the part is replaced.

Next, the variable i is incremented by 1 in Step **S506**, then it is judged whether all the PH counter values have been judged as described above in Step **507**. In the case where there remain other PM counters i to be determined, the PM transmission judging routine, returns to Step **S502** to repeat the sequence of Steps **S502** to **S506** until all the PM counter values are determined. When all the judgments have been completed, this routine returns to the main routine.

FIG. **14** is a flow chart showing procedure of the data transmission processing routine executed in Step **S11**.

First, in Step **601**, it is judged whether any of the transmission flag of the trouble, fixed time, warning, manual, and PM transmission flags are set to 1. In the case where any one of the above 5 flags is set to 1 and in the case where there is no need to wait to redial in Step **S602**, communication operation is effected through the modem **28** between the data terminal device **2** and the central unit **3** in the subsequently steps.

In Step **S603**, it is judged whether the data terminal device **2** and the central unit **3** are already in communication with each other through the communication line. In the case where the data terminal device **2** and the central unit **3** are already in communication with each other, and the modem **28** is ready, the data is transmitted to the central unit **3** until all the data transmission is completed in Step **S608**.

The transmitted data consist of each counter value of JAM trouble code **72**, JAM trouble counter **73**, counter **74** provided for each size of copy paper, and PM counter **75**, the clear value of the PM counter **75** and element data (X, R).

Upon completion of the data transmission, each transmission flag is reset to 0 in Step **S606**, and then the communication line is disconnected in Step **607**. In the case where it is determined that the communication line is not connected in Step **S603**, this routine proceeds to Step **S609** to dial.

Next, in Step **S610**, it is judged whether or not the telephone connected to the data terminal device **2**, from which the data is transmitted, is engaged. In the case where the telephone is not engaged, it is judged whether or not the telephone provided for the central unit **3**, to which the data is transmitted, is engaged in Step **S612**. In the case where either one of the above two telephones is engaged, a redialing time is set in Steps **S611**, **S613**. When such processings as described above are completed, the data transmission processing routine returns to the main routine.

Next, there will be described operation in the central unit **3**.

FIG. **15** is a flow chart showing operational procedure of the main routine of the central unit **3**.

First, the central unit **3** sets environment including operational conditions of the modem **35**, the printer **36** or the like in Step **S1001**. Then, the central unit **3** determines which function key(s) is selected by the operator in Steps **S1002** to **S1014**. The operator can select the desired function key from the function keys F1 through F7 by keyed input. The central unit **3** performs processing corresponding to each of the selected function keys. Thereafter the central units **3** performs the fixed transmission time supervisory processing in Step **S1016**, and repeats the process of the Steps **S1002** to **S1016**.

In the case where a function key **F1** is selected in Step **S1002**, a model registration processing is performed in Step **S1003**. In this operation, model of the copying machine, item number, name and standard threshold of the element data, and each counter standard threshold are registered with the use of keys.

In the case where a function key F2 is selected in Step **S1004**, a user master input processing is performed in Step **S1005**. In this operation, a user's name, address, telephone number, model name, model number, transmission time and the like of the copying machine **1** are registered with the use of keys. In addition, an ID number of the data terminal device **2** is automatically numbered.

In the case where a function key F3 is selected in Step **S1006**, a trouble condition display processing is executed in Step **S1007**. In this operation, user information including a user's name, address, telephone number, and a model of the copying machine **1** currently in trouble condition, and the time when the trouble arose are displayed together with content of troubles. On one portion of the screen is normally displayed the number of troubles. Also, the number of trouble is displayed on one portion of any type of screen.

In the case where a function key F4 is selected in Step **S1008**, a warning condition display processing is executed in Step **S1009**. In this operation, the user information of the copying machine **1** currently in warning condition is displayed together with content of the warning. In addition, the number of warnings is always displayed on one portion of the screen irrespective of the operation of the function key F4.

In the case where a function key F5 is selected in Step **S1010**, an unreceived condition display processing is executed in Step **S1011**. In this operation, the user information of the copying machine **1** registered as an unireceived information in the fixed transmission time supervisory pro-

cessing in Step S1016 to be described below is displayed together with predetermined fixed transmission time. Also, on one portion of the screen is always displayed the number of the unreceived information.

FIG. 18 is a schematic diagram showing an example of a display screen of unreceived condition display. On the upper portion of the screen, there are displayed the numbers of unreceived informations and troubles. On the screen, two user informations are displayed, and scheduled fixed time transmission times are displayed on respective upper right corners.

In the case where a function key F6 is selected in Step S1012, a user information display processing is executed in Step S1013. In this operation, a particular user is selected, and information of the selected user is displayed. Further, in the case where a sub-menu is selected here, total counter, which is a sum of counters provided for each copy paper size, and counters provided for each copy paper size, JAM trouble counter, PM counter and element data are displayed month by month, or item by item.

In the case where a function key F7 is selected in Step S1014, a billing processing is executed in Step S1015. In this operation, a billing amount is calculated in accordance with the counter value of the total counter and the calculation formula, and a bill is issued.

FIG. 16 is a flow chart showing procedure of the fixed transmission time supervisory processing executed in Step S1016.

First, a terminal device number i is set to 0 in Step S1201. Then, it is judged whether the fixed transmission time of the data terminal device 2 has already passed the present time in Step S1202.

When one fixed time transmission is completed, a new fixed transmission time is set for the subsequent transmission. In view of this, as long as the fixed time transmission is normally executed, such a thing will not occur that the fixed transmission time has already passed the present time. Accordingly, in the case where the fixed transmission time has already passed the present time, it is judged that a communication trouble has occurred due to some sort of possible causes. As a result, the information on the copying machine 1 is registered in the storing unit 34 as unreceived information in Step S1203. Then, the terminal device number i is incremented by 1 in Step S1204. Consequently, in Step S1205, it is judged whether all the data terminal devices 2 have been supervised. In the case where all the data terminal devices 2 have been supervised, the routine returns to the main routine. In the case where there remains some more data terminal devices 2 to be supervised, i.e., the terminal device number i is not greater than the number of data terminal device 2, this routine returns to Step S1201 and repeats the sequence of Steps S1201 to S1204 until all the data are supervised. The unreceived information registered in this routine is displayed in the above explained unreceived condition display processing, enabling the early detection of trouble in the communication line 6 or abnormality in the data terminal device 2.

Further, after the environment is set in Step S1001, interrupt of the data receiving/processing from the data terminal device 2 through the RS-232C I/F 26 and the modems 28, 35 is enabled. Therefore, even while any operation of Steps S1002 to S1016 is in process, the data receiving processing in Step S1017 is always preferentially executed.

FIG. 17 is a flow chart showing procedure of the data receiving/processing routine.

When the data is transmitted from each data terminal device 2 to the central unit 3, in which an interrupt request for receiving the data is generated, an ID number and each data in the data terminal device 2 are received in the predetermined order in Step S1101. Then, it is judged whether an error has occurred in receiving the data in Step S1102. In the case where the error has occurred, the data terminal device 2 is requested to transmit the data again in Step S1103. In the case where no error has occurred in Step S1102, this routine waits until the data transmission is completed in Step S1104, and the communication between the central unit 3 and the data terminal device 2 is shut off in Step S1105. Consequently, each transmitted data is totaled item by item, and month by month in Step S1106. In accordance with these data, the user's information is displayed and bills are issued.

Although the above embodiment is explained using the copying machine as a terminal device, it will be appreciated that the present invention is applicable to any device or apparatus which requires field service, such as an automatic vendor.

In addition, although a fixed transmission time is transmitted from the central unit to the data terminal device each time the fixed time transmission from the data terminal device to the central unit is completed in the above embodiment, the present invention is not limited to this. It may be appropriate that a fixed transmission time is prestored in a ROM provided in the data terminal device or preset by dialing.

As described above, according to the present invention, a fixed data transmission time for the terminal device is always supervised by controlling means. The present invention is so constructed as to display identification information of a communication device provided for the terminal device in the case where the controlling means has not received the information despite the fact that the fixed transmission time has already passed the present time. Accordingly, the controlling means can identify the terminal device which has not transmitted the data even past the fixed transmission time, thereby enabling early detection of abnormality in the communication device or communication line.

Further, clocking means for clocking the present time and storing means for storing the information to be transmitted at transmission time, both means being disposed in the communication device of the terminal device, are backed up by a back-up power source. Accordingly, when the power is supplied after being shut off, the backed up present time is compared with the fixed transmission time. In the case where the fixed transmission time has already passed the present time, the information which should have been transmitted at the fixed transmission time is read out of the storing means, and transmitted to the controlling means. Since provided with the above two means, the terminal device can assuredly transmit the information which should have been transmitted at the fixed transmission time when the power is supplied again thereto, even in the case where the power supply of the terminal device is shut off at the transmission time. Therefore, the controlling means can assuredly collect the information which should halve been received at the fixed transmission time, thereby reinforcing controlling function thereof.

Further, in the case where an image forming apparatus has had a trouble, it is determined that the image forming apparatus has recovered from its trouble condition to its normal condition by detecting that a sheet of paper is discharged therefrom. Accordingly, such likelihood can be eliminated as to report recovery from the trouble to the central unit many times for the same trouble as opposed to the conventional recovery judgment implemented by, for

example, actuating a reset button. Hence, only the accurate information is transmitted to the central unit.

As this invention may be embodied in several forms without departing from the spirit of essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within meets and bounds of the claims, or equivalence of such meets and bounds thereof are therefore intended to be embraced by the claims.

What is claimed is:

1. A centralized control system, comprising:

at least one or more terminal device;

communicating means, provided for each of said at least one terminal device, for transmitting information relating to operational condition of each of said at least one terminal device at a predetermined time; and

control means, connected to each of said communicating means through communication lines, for controlling each of said at least one terminal device in accordance with said information transmitted from each of said communicating means;

said control means having:

supervising means for supervising transmission of information at the predetermined time determined for each of said communicating means;

detecting means for detecting which of said communicating means has not normally transmitted the information at said predetermined time thereof based on a supervisory result of said supervising means; and

display means for displaying information identifying the communicating means detected by said detecting means and information of said predetermined time.

2. A centralized control system as set forth in claim **1**, wherein said at least one terminal device is an image forming apparatus.

3. A centralized control system as set forth in claim **2**, wherein said image forming apparatus has counters provided for each paper size, and information relating to operational condition includes a number of image forming operation in accordance with each paper size.

* * * * *

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United States Patent [19]

Miyawaki

[11] Patent Number: 5,995,771

[45] Date of Patent: Nov. 30, 1999

[54] **IMAGE FORMING APPARATUS ADMINISTRATION SYSTEM**

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[73] Assignee: **Ricoh Company, Ltd.**, Tokyo, Japan

[21] Appl. No.: **09/037,915**

[22] Filed: **Mar. 9, 1998**

[30] **Foreign Application Priority Data**

Mar. 7, 1997 [JP] Japan 9-052935

[51] **Int. Cl.**[6] **G03C 15/00**; G03C 21/00

[52] **U.S. Cl.** **399/8**; 399/9; 399/11; 399/75; 399/77

[58] **Field of Search** 399/75, 77, 8, 399/9, 10, 11; 395/114; 358/406, 437, 441, 442

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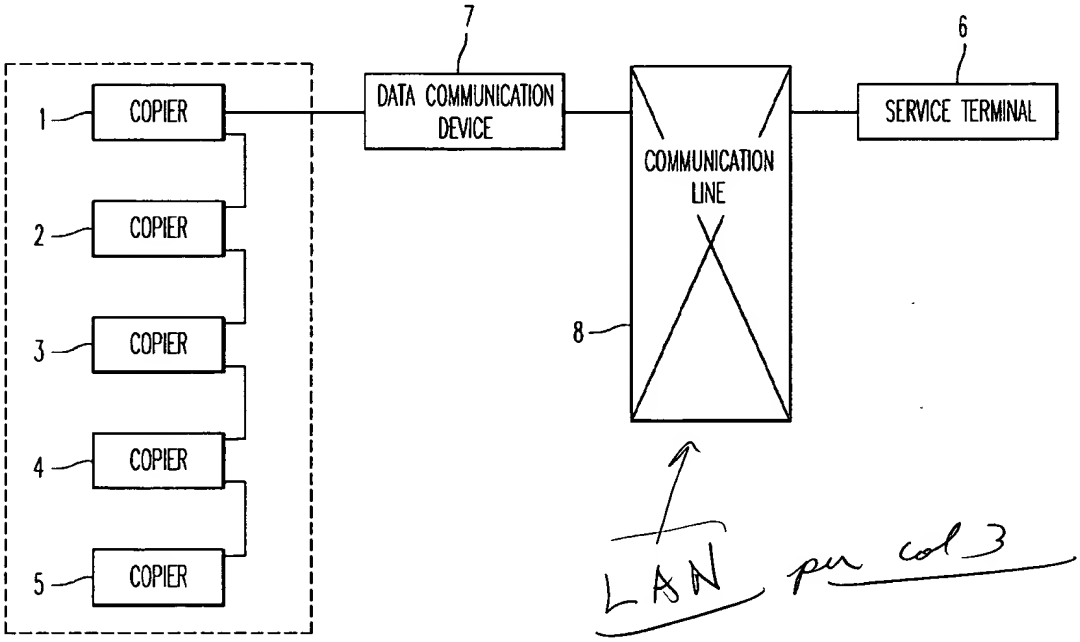
7-200797	8/1995	Japan .

Primary Examiner—Richard Moses
Assistant Examiner—Shival Virmani
Attorney, Agent, or Firm—Oblon, Spivak, McClelland, Maier & Neustadt, P.C.

[57] **ABSTRACT**

An image forming apparatus administration system includes an image forming apparatus for forming an image on a sheet of paper. A service terminal is connected to the image forming apparatus through a communication line and administers conditions of the image forming apparatus. An operation panel has operation keys and a screen. A changing device can be operated to change an indication of the operation panel from an indication for inputting an operation command for image formation to an indication for inputting a request command for transmitting data from the image forming apparatus to the service terminal. A transmitting device can transmit the data in response to the request command and the changing device changes the indication of the operation panel from the indication for inputting a request command for transmitting data from the image forming apparatus to the service terminal to the indication for inputting an operation command for image formation before the transmission of the data is completed.

27 Claims, 12 Drawing Sheets



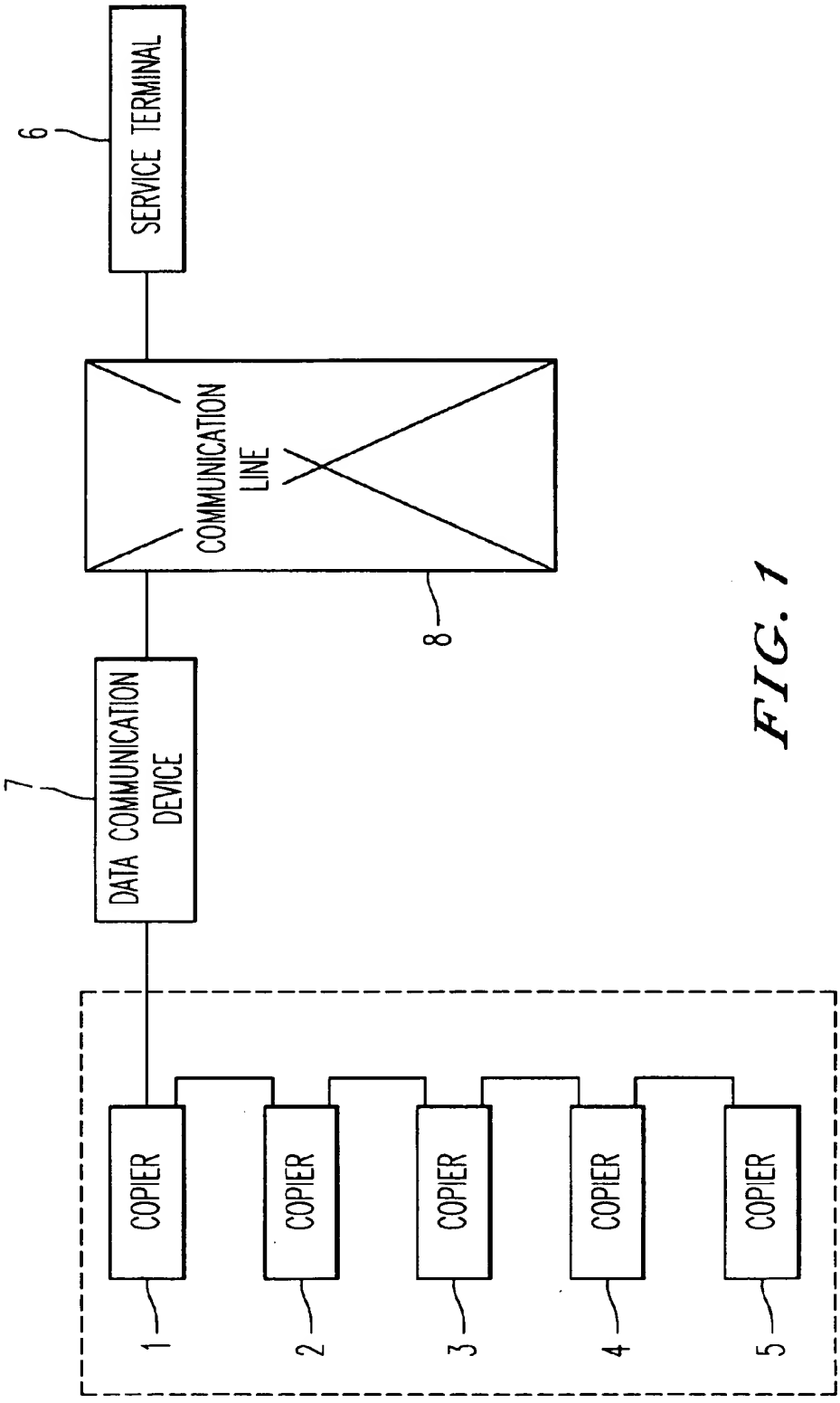

SERVICE TERMINAL
6
COMMUNICATION LINE
8
DATA COMMUNICATION DEVICE
7
COPIER
COPIER
COPIER
COPIER
COPIER
1
2
3
4
5

FIG. 1

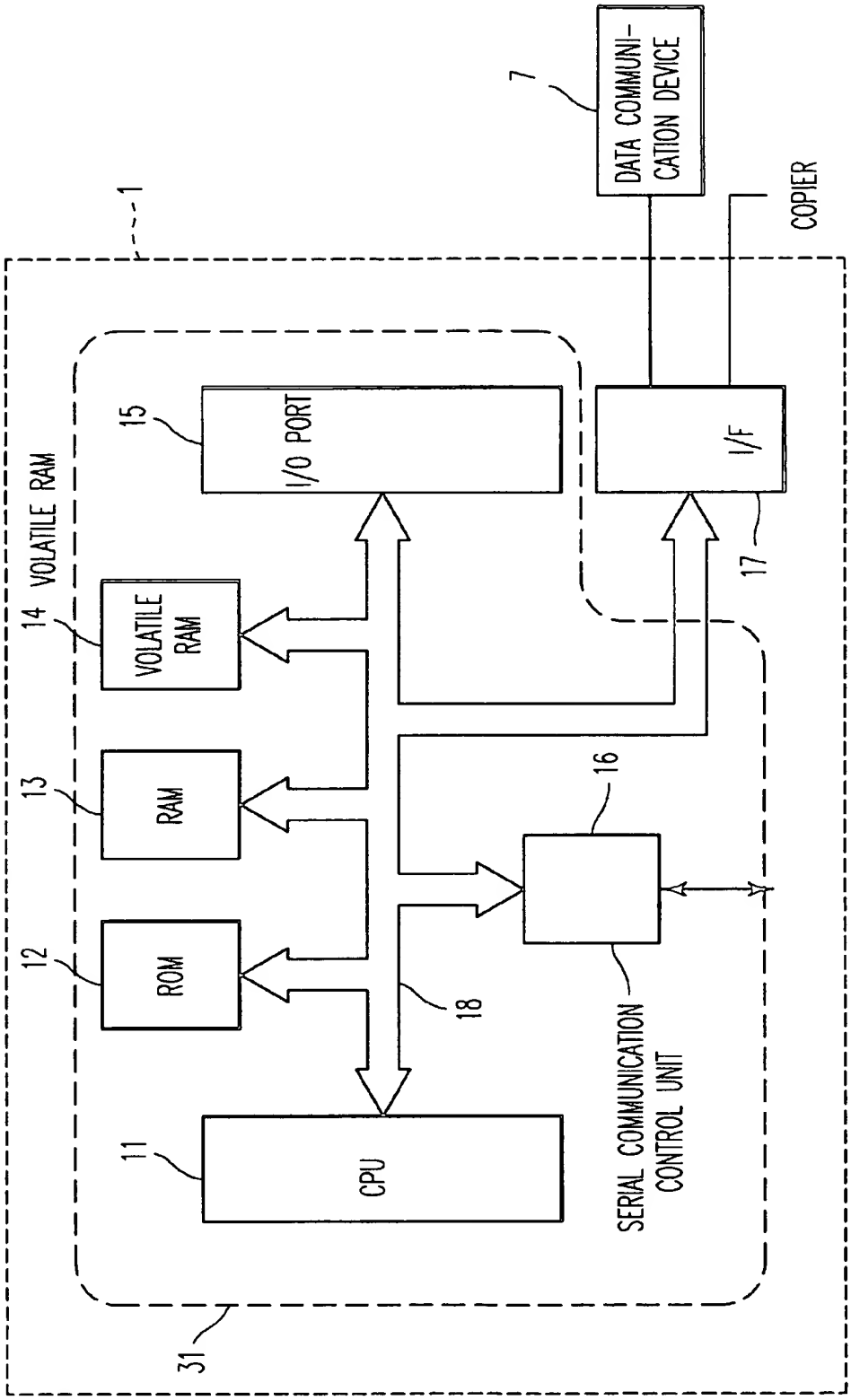

DATA COMMUNI-
CATION DEVICE
7
COPIER
1
15
I/O PORT
I/F
17
VOLATILE RAM
14
VOLATILE
RAM
13
RAM
16
12
ROM
18
SERIAL COMMUNICATION
CONTROL UNIT
11
CPU
31

FIG. 2

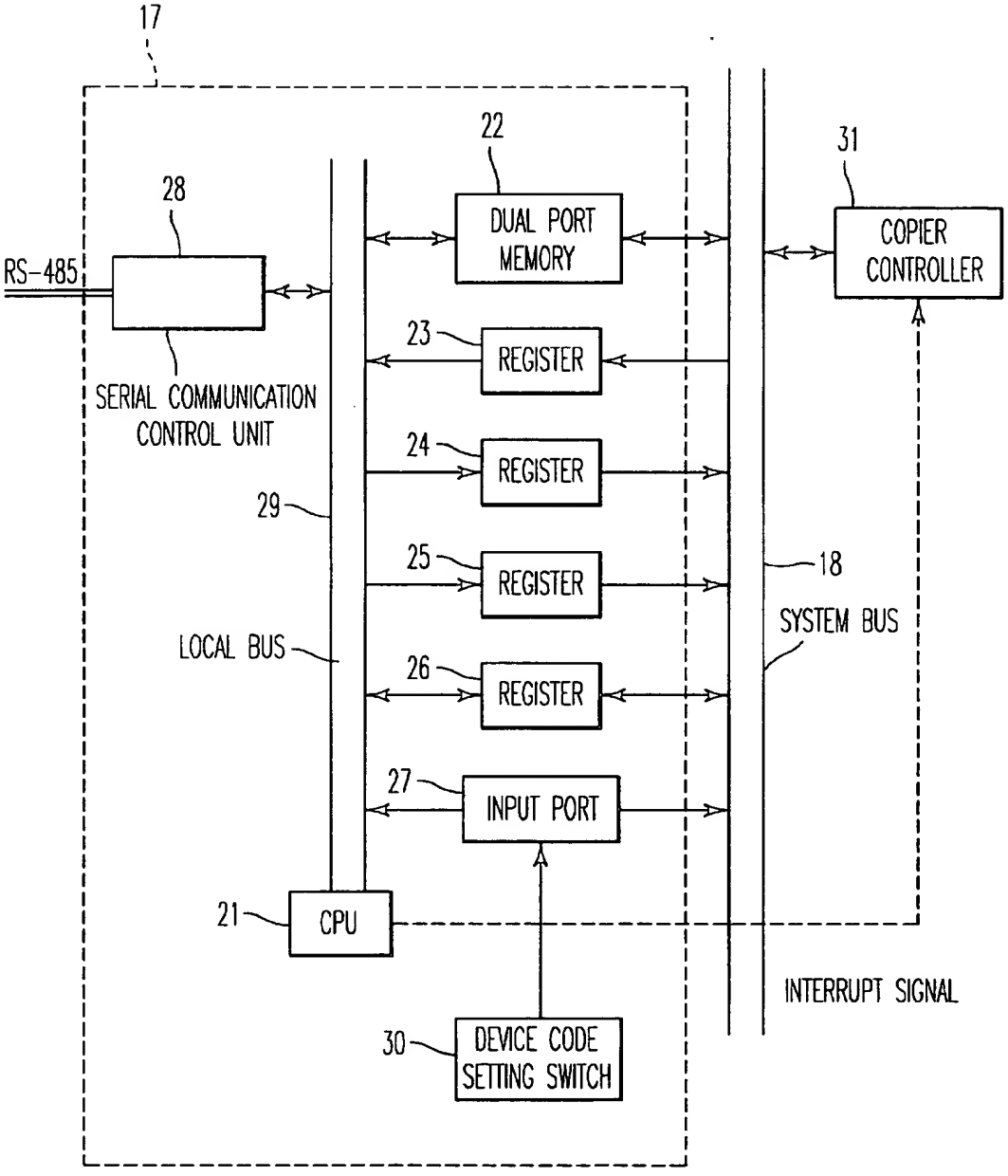

17
22
31
28
DUAL PORT MEMORY
COPIER CONTROLLER
RS-485
23
REGISTER
SERIAL COMMUNICATION CONTROL UNIT
24
REGISTER
29
25
REGISTER
18
SYSTEM BUS
LOCAL BUS
26
REGISTER
27
INPUT PORT
21
CPU
INTERRUPT SIGNAL
30
DEVICE CODE SETTING SWITCH

FIG. 3

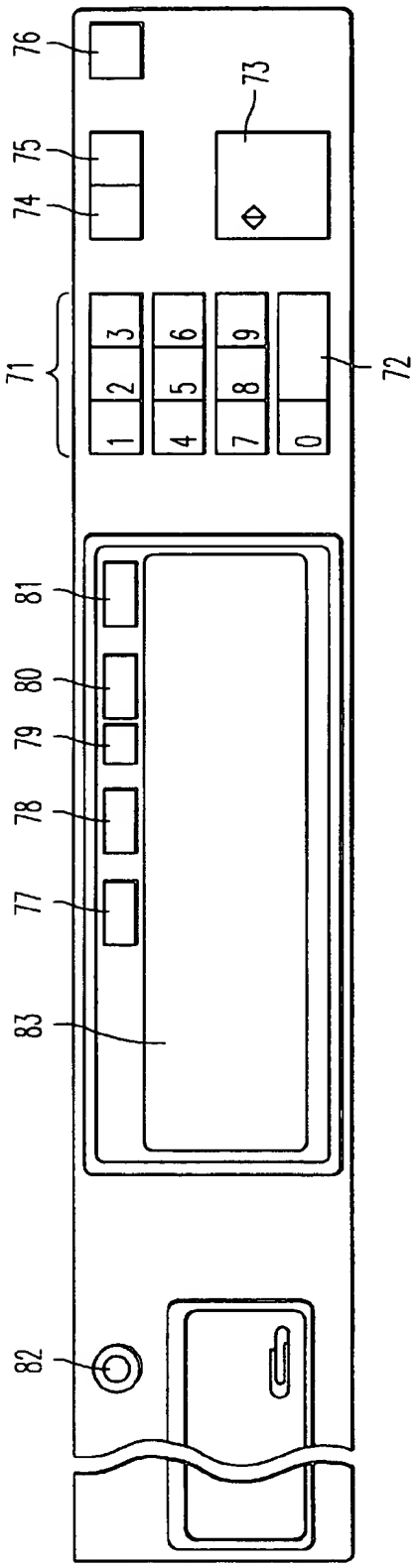


FIG. 4

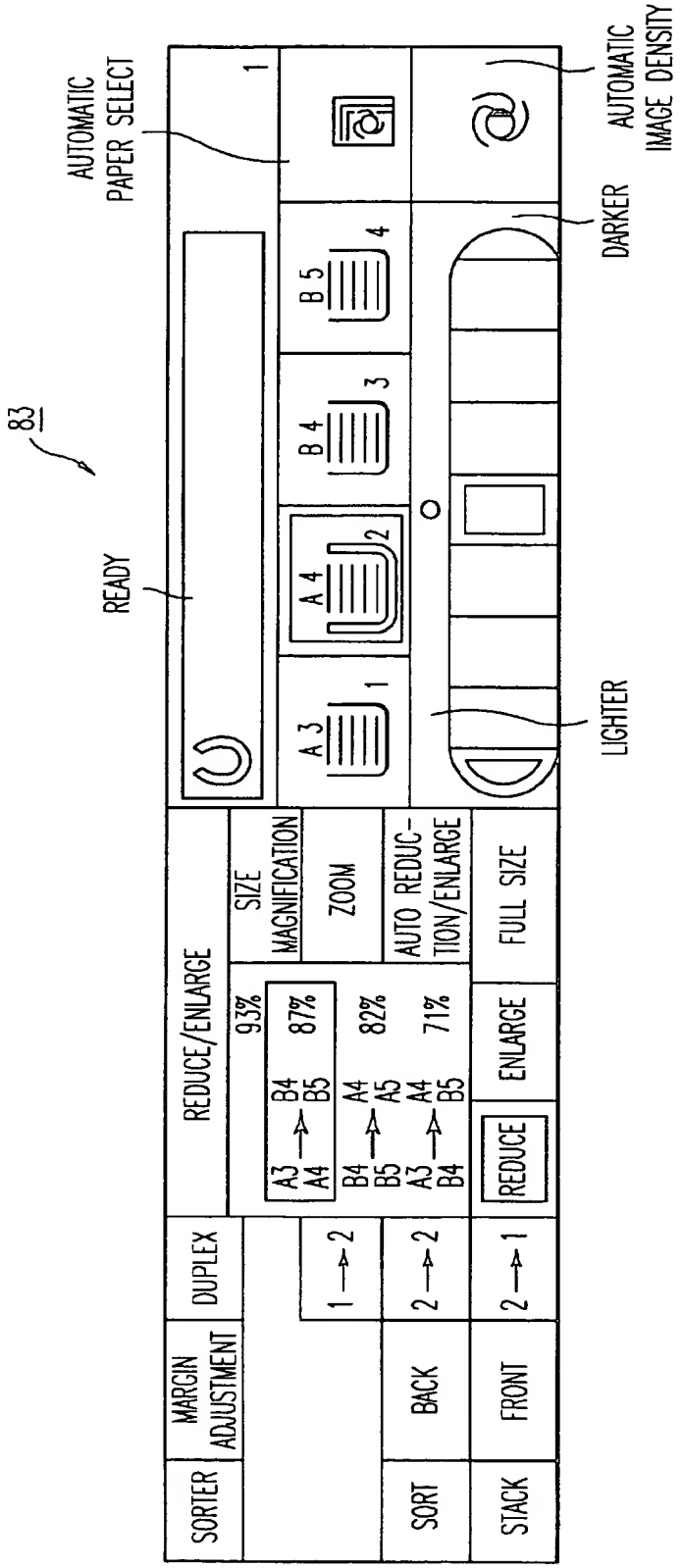

83
READY
AUTOMATIC PAPER SELECT
AUTOMATIC IMAGE DENSITY
DARKER
LIGHTER
A3 1
A4 2
B4 3
B5 4
1
SORTER
MARGIN ADJUSTMENT
DUPLEX
REDUCE/ENLARGE
SIZE MAGNIFICATION
ZOOM
AUTO REDUC-TION/ENLARGE
FULL SIZE
1 → 2
2 → 2
2 → 1
SORT
BACK
FRONT
STACK
93%
87%
82%
71%
A3 → A4
B4 → B5
B4 → B5
A4 → A5
A3 → B4
A4 → B5
REDUCE
ENLARGE

FIG. 5

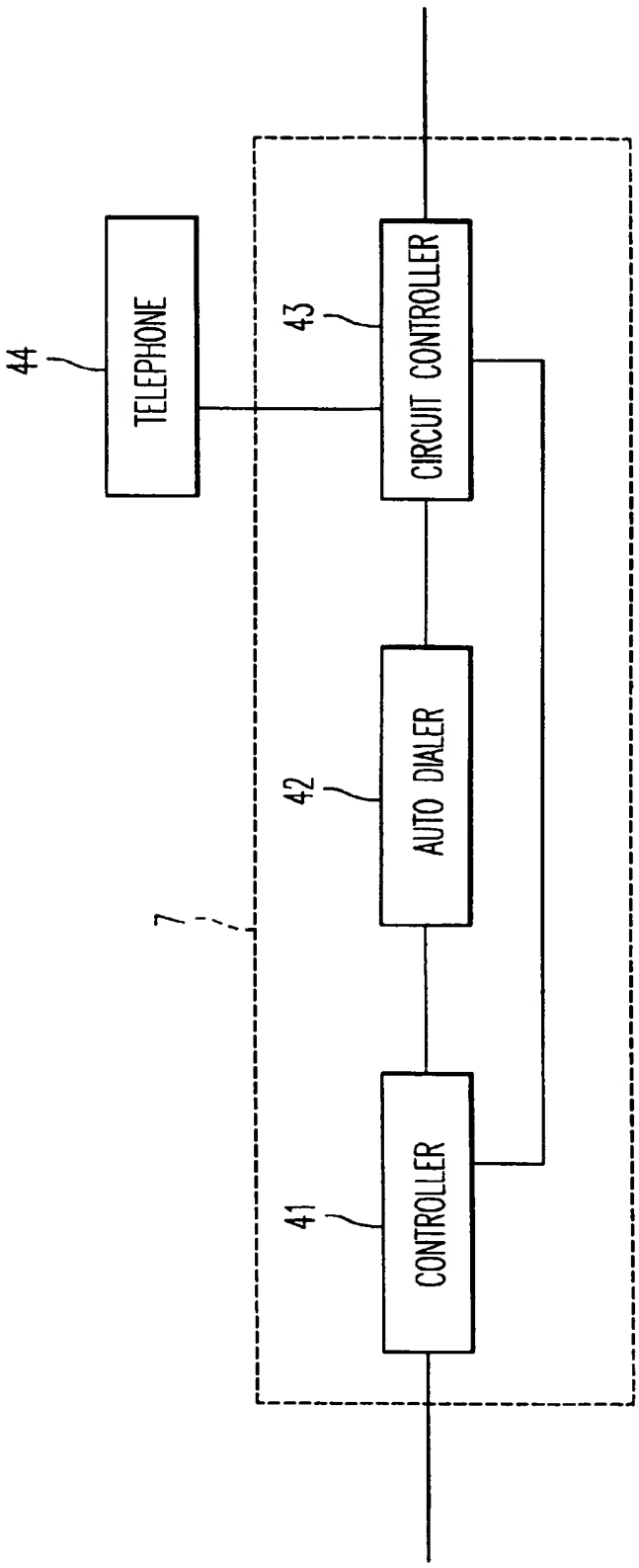

TELEPHONE
44
43
CIRCUIT CONTROLLER
42
AUTO DIALER
7
41
CONTROLLER

FIG. 6

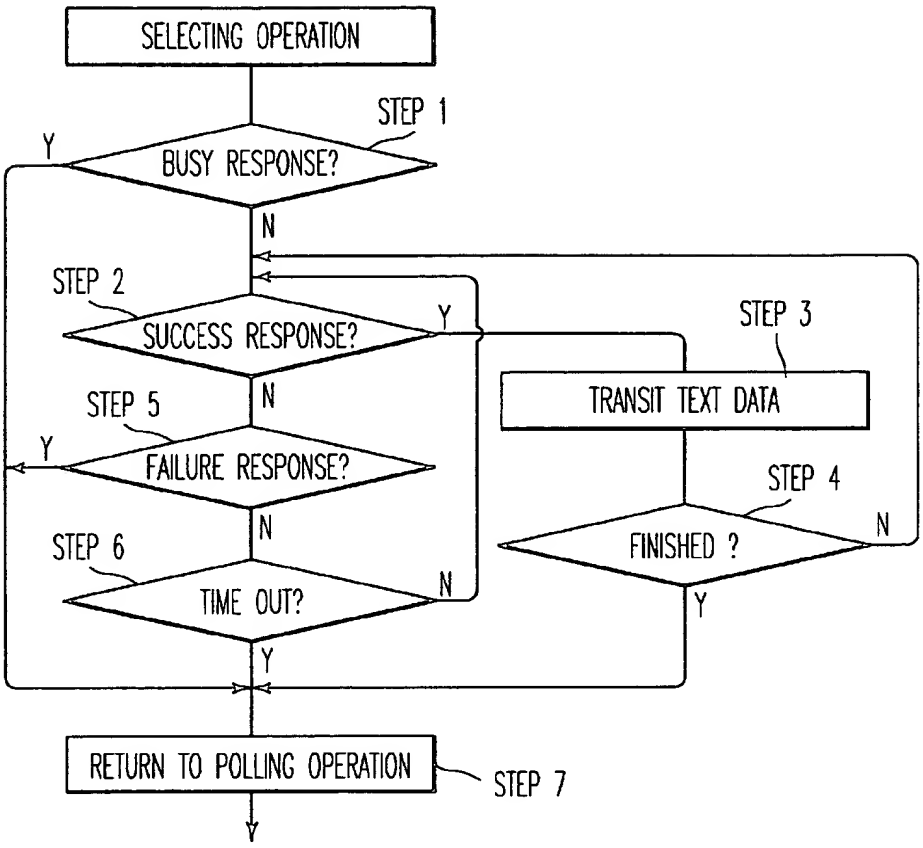

SELECTING OPERATION
STEP 1
BUSY RESPONSE?
Y
N
STEP 2
SUCCESS RESPONSE?
Y
N
STEP 3
TRANSIT TEXT DATA
STEP 5
FAILURE RESPONSE?
Y
N
STEP 4
FINISHED ?
N
Y
STEP 6
TIME OUT?
N
Y
RETURN TO POLLING OPERATION
STEP 7

FIG. 7

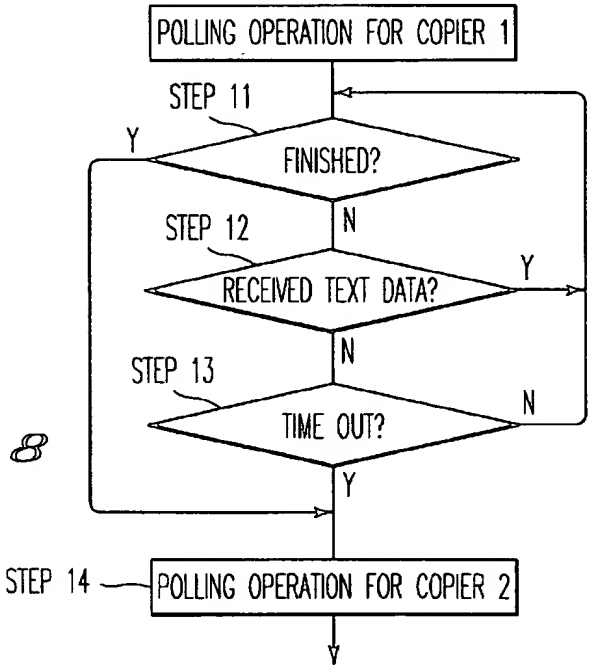

POLLING OPERATION FOR COPIER 1
STEP 11
FINISHED?
Y
N
STEP 12
RECEIVED TEXT DATA?
Y
N
STEP 13
TIME OUT?
N
Y
STEP 14
POLLING OPERATION FOR COPIER 2

FIG. 8

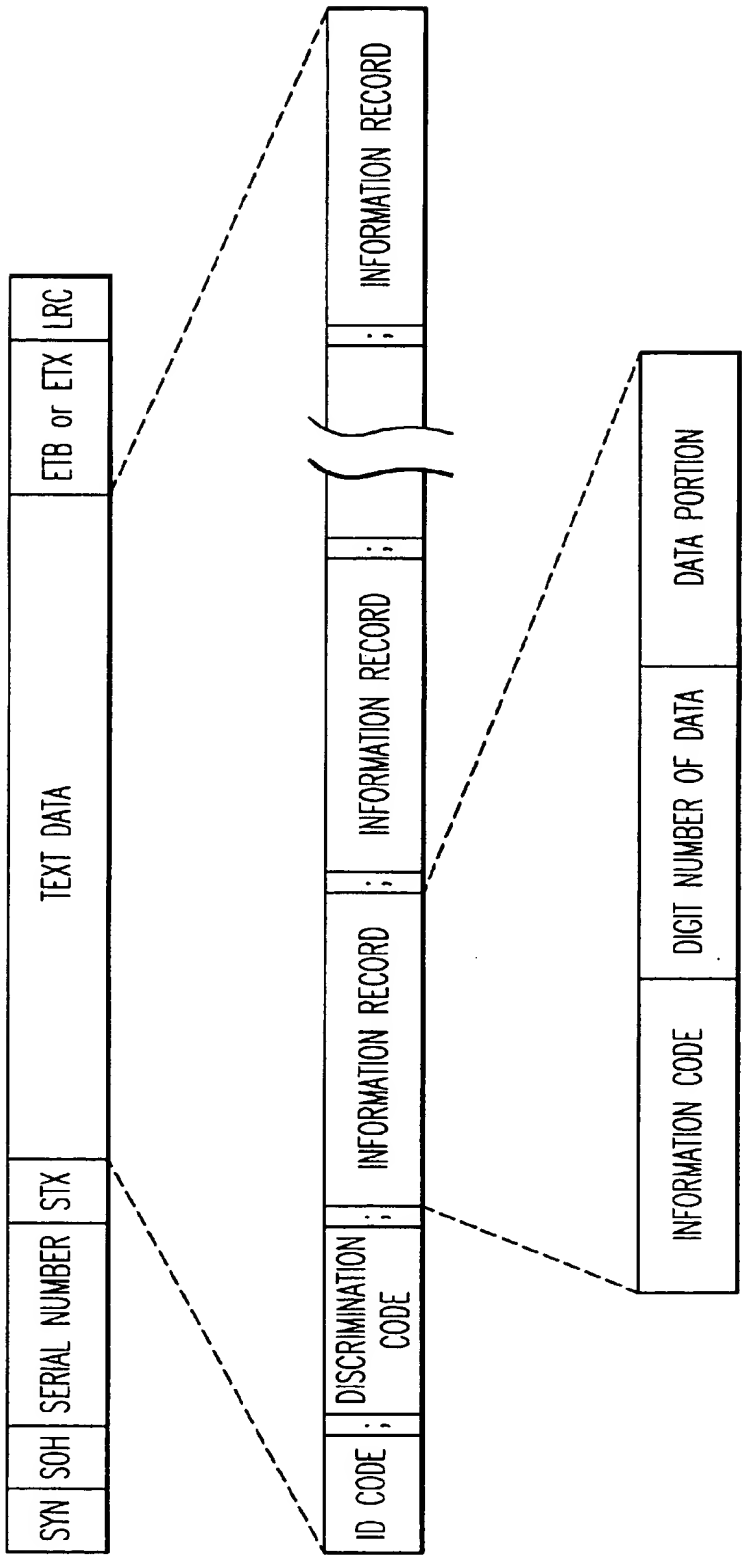

SYN
SOH
SERIAL NUMBER
STX
TEXT DATA
ETB or ETX
LRC
ID CODE
DISCRIMINATION CODE
INFORMATION RECORD
INFORMATION RECORD
INFORMATION RECORD
INFORMATION CODE
DIGIT NUMBER OF DATA
DATA PORTION

FIG. 9

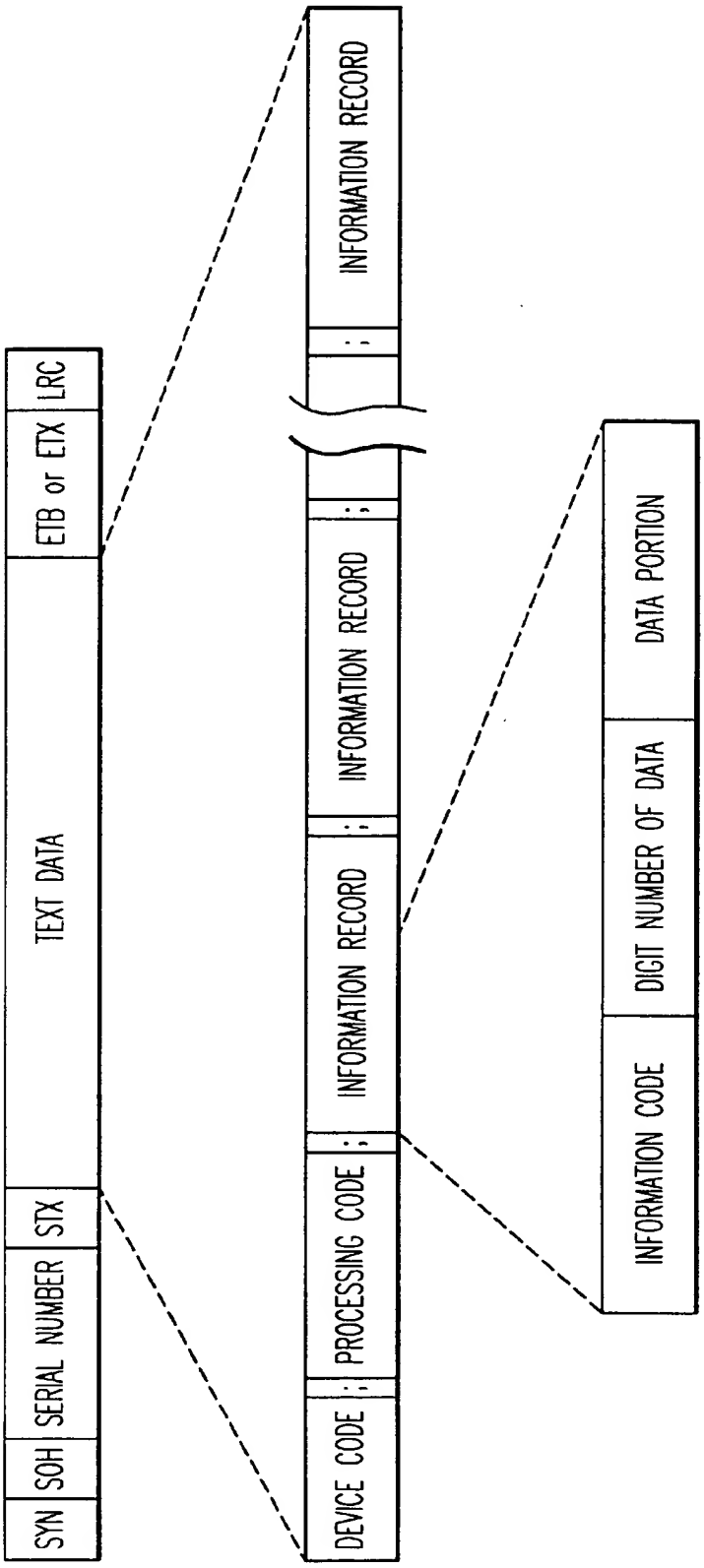

SYN
SOH
SERIAL NUMBER
STX
TEXT DATA
ETB or ETX
LRC
DEVICE CODE
PROCESSING CODE
INFORMATION RECORD
INFORMATION RECORD
INFORMATION RECORD
INFORMATION CODE
DIGIT NUMBER OF DATA
DATA PORTION

FIG. 10

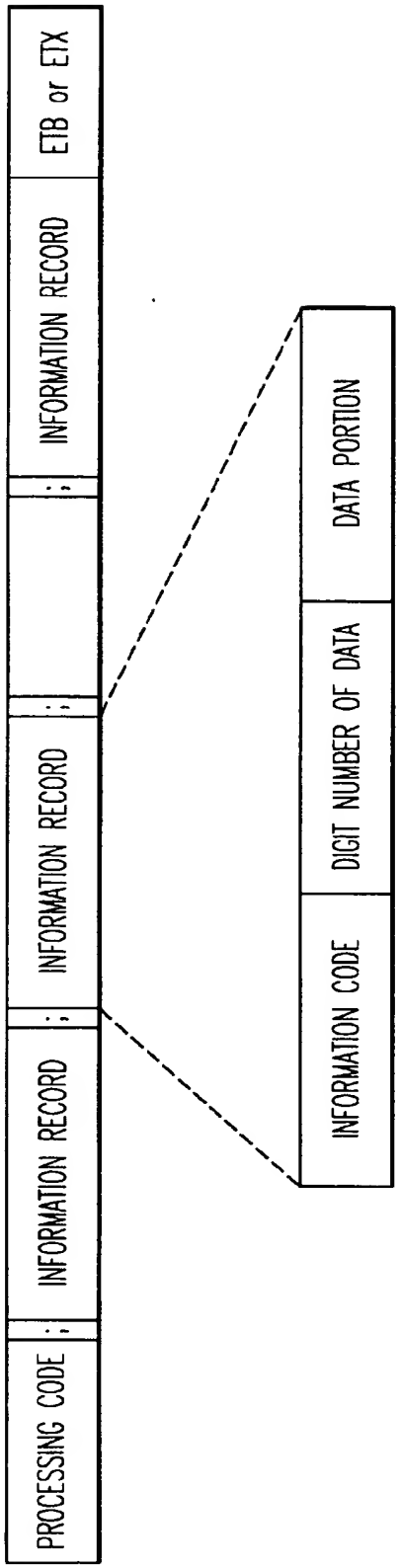

PROCESSING CODE
INFORMATION RECORD
INFORMATION RECORD
INFORMATION RECORD
ETB or ETX
INFORMATION CODE
DIGIT NUMBER OF DATA
DATA PORTION

FIG. 11

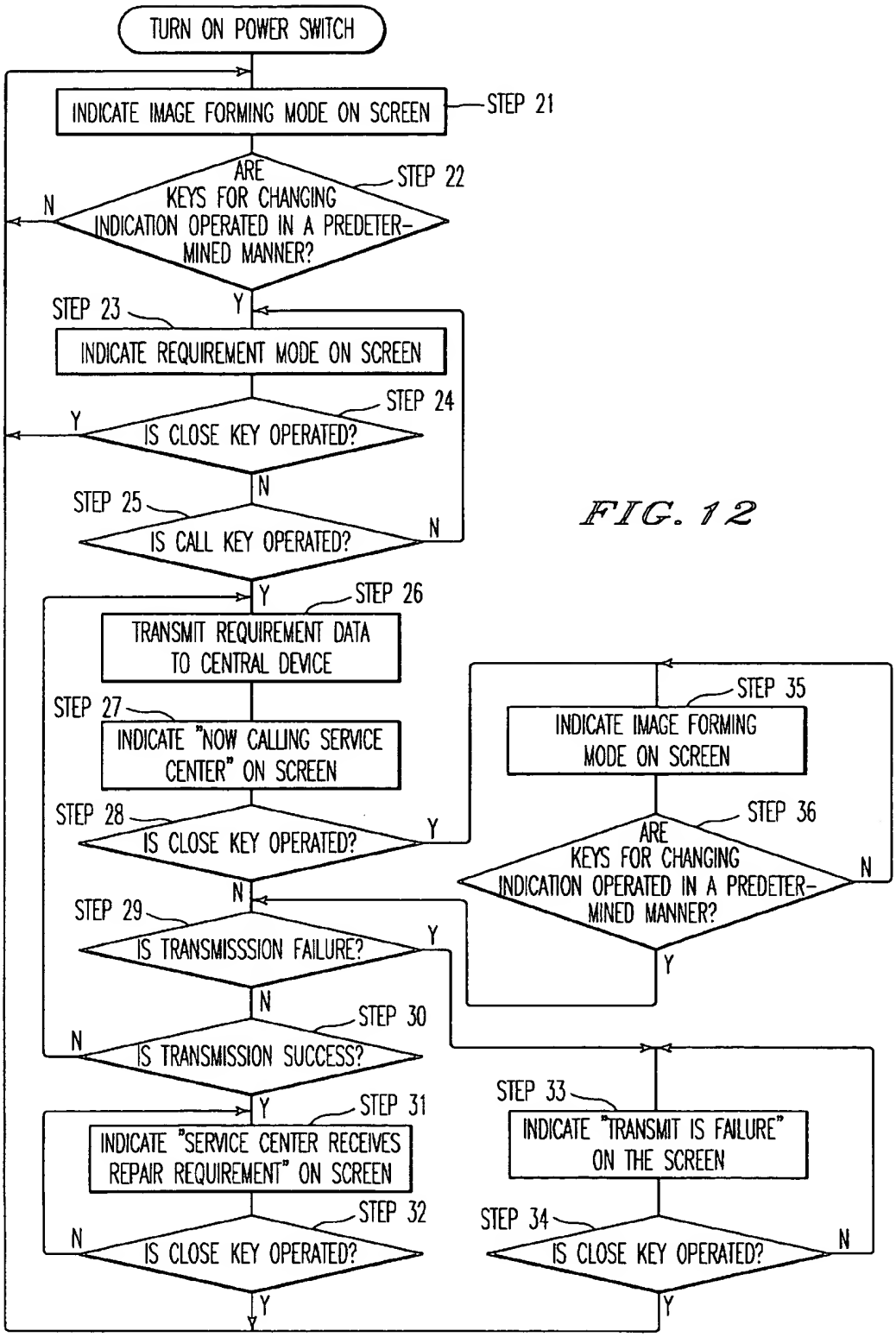

TURN ON POWER SWITCH
INDICATE IMAGE FORMING MODE ON SCREEN
STEP 21
ARE KEYS FOR CHANGING INDICATION OPERATED IN A PREDETERMINED MANNER?
STEP 22
N
Y
STEP 23
INDICATE REQUIREMENT MODE ON SCREEN
STEP 24
IS CLOSE KEY OPERATED?
Y
N
STEP 25
IS CALL KEY OPERATED?
N
Y
STEP 26
TRANSMIT REQUIREMENT DATA TO CENTRAL DEVICE
STEP 27
INDICATE "NOW CALLING SERVICE CENTER" ON SCREEN
STEP 28
IS CLOSE KEY OPERATED?
Y
N
STEP 29
IS TRANSMISSSION FAILURE?
Y
N
STEP 30
IS TRANSMISSION SUCCESS?
N
Y
STEP 31
INDICATE "SERVICE CENTER RECEIVES REPAIR REQUIREMENT" ON SCREEN
STEP 32
IS CLOSE KEY OPERATED?
N
Y
STEP 35
INDICATE IMAGE FORMING MODE ON SCREEN
STEP 36
ARE KEYS FOR CHANGING INDICATION OPERATED IN A PREDETERMINED MANNER?
N
Y
STEP 33
INDICATE "TRANSMIT IS FAILURE" ON THE SCREEN
STEP 34
IS CLOSE KEY OPERATED?
N
Y

FIG. 12

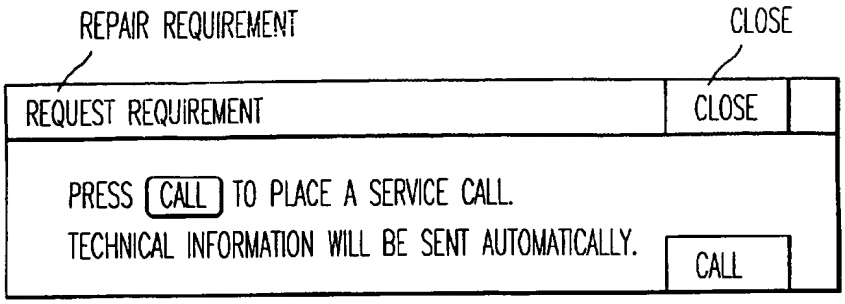


FIG. 13

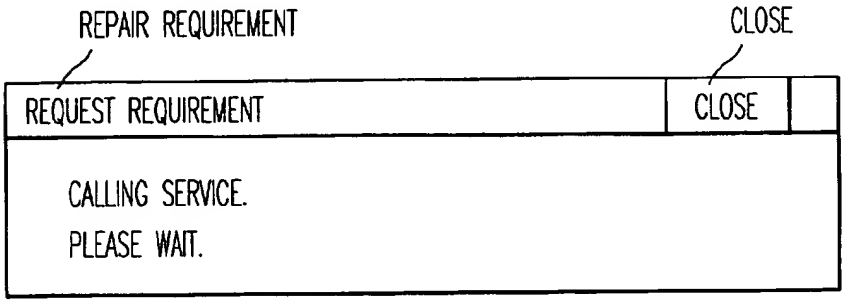


FIG. 14

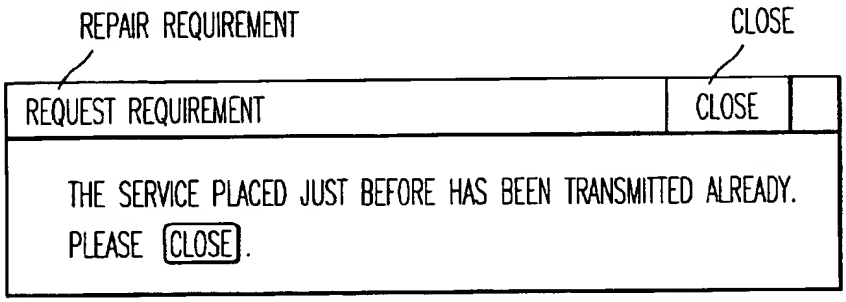


FIG. 15

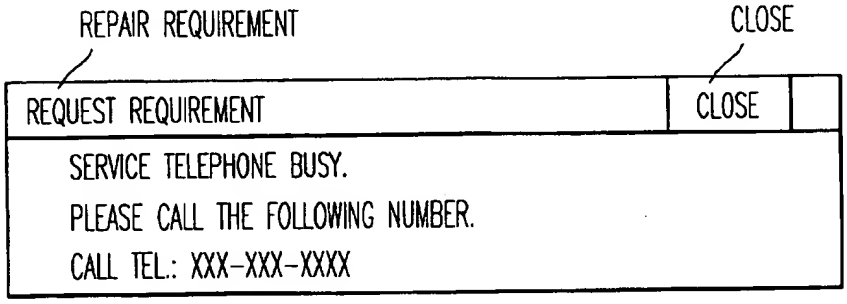


FIG. 16

IMAGE FORMING APPARATUS ADMINISTRATION SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image forming apparatus administration system in which at least one image forming apparatus, such as a copier, a printer, a facsimile machine, or similar image forming apparatus, and a service terminal are connected through a communication line. The present invention is further related to the control of a display of the image forming apparatus during a communication process with the service terminal.

2. Discussion of Background

As an example of an image forming apparatus administration system, a system is known in which an image forming apparatus such as a copier can be connected to a service terminal, which for example may be installed in a service center, utilizing a communication line, such as a public line or the like.

With this type of image forming apparatus administration system, an operator of the image forming apparatus can transmit a request, such as a repair request and a request of a need for consumption articles such as sheets of paper and toner, to the service terminal by inputting a transmission command from keys on an operation panel of the image forming apparatus. If the image forming apparatus cannot be connected to the service terminal, a subsequent attempt to establish communication may be made.

In this type of system, the operator of the image forming apparatus can go to the keyboard of the image forming apparatus and enter a communication mode to connect to the service terminal via the communication line. In this system after the operator inputs a request at the image forming apparatus, for example at a keypad or a display at the image forming apparatus, the request is then sent to the service terminal through the communication line. In this instance the operator must then wait for a response to this request from the service terminal before the image forming apparatus can be utilized for an image forming operation.

That is, in this system after the request is issued from the image forming apparatus to the service terminal through the communication line, the image forming apparatus cannot execute image forming operations until a response to this request is issued from the service terminal and is then communicated from the service terminal through the communication line to and received at the image forming apparatus. This results in an inefficient use and unnecessary downtime in the operation of the image forming apparatus.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a novel image forming apparatus administration system in which downtime of the image forming apparatus is as short as possible.

It is another object of the present invention to implement a novel control of communication between an image forming apparatus and a service terminal and also to control a display device of the image forming apparatus.

These and other objects of the present invention are achieved by a novel image forming apparatus and method of operating an image forming apparatus in which when a service request is made to a service terminal from the image forming apparatus, the image forming apparatus can still execute image forming operations while awaiting a response to the service request from the service terminal.

Further, in the present invention a display of an image forming apparatus can generate display images for both an image forming mode and a communication mode. In the present invention, this display can be changed from a display for the image forming mode to a display for the communication mode if an operator wishes to transmit a service request to a service terminal. Further, the display can be changed back to the image forming mode display before the communication between the image forming apparatus and the service terminal is completed, i.e. before the response to the service request from the image forming apparatus is received at the image forming apparatus from the service terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the present invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. **1** is a schematic block diagram of an image forming apparatus administration system embodying the present invention;

FIG. **2** is a schematic block diagram of an image forming apparatus embodying the present invention;

FIG. **3** is a schematic block diagram of an interface embodying the present invention;

FIG. **4** shows an operation panel in the image forming apparatus embodying the present invention;

FIG. **5** shows a screen of the operation panel of FIG. **4** with various messages on a display according to the present invention;

FIG. **6** is a schematic block diagram of a data communication device embodying the present invention;

FIG. **7** is a flowchart showing a selecting operation according to the present invention;

FIG. **8** is a flowchart showing a polling operation according to the present invention;

FIG. **9** shows a data format communicated between a service terminal and a data communication device in the present invention;

FIG. **10** shows a data format communicated between a data communication device and an interface in an image forming apparatus in the present invention;

FIG. **11** shows a data format communicated between an interface and a controller of an image forming apparatus in the present invention;

FIG. **12** is a flowchart showing a process for indicating a message on a screen of FIG. **5** according to the present invention;

FIG. **13** shows a screen in which a message is displayed indicating that a transmission request can be input as an operation of the present invention;

FIG. **14** shows a screen in which a message is displayed indicating a transmission is occurring as an operation of the present invention;

FIG. **15** shows a screen in which a message is displayed indicating that a transmission has been completed as an operation of the present invention; and

FIG. **16** shows a screen where a message is displayed indicating that a transmission has failed because a communication line is busy as an operation of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts

throughout the several views, and more particularly to FIG. 1 thereof, an image forming administration system is shown which includes five copiers 1 to 5, as examples of image forming apparatus, connected to a service terminal 6 through a data communication device 7 and a communication line 8. The data communication device 7 and service terminal 6 administer the copiers 1 to 5.

The system shown in FIG. 1 can be structured such that the service terminal 6 is a central control device located at a central station which is remotely positioned from the copiers 1 to 5. This service terminal 6 can also be located within a local region shared with the copiers 1 to 5. Further, the copiers 1 to 5, data communication device 7, communication line 8 and service terminal 6 can all be connected by a local area network (LAM). The physical positions and the exact nature of the form of the communication between the devices in FIG. 1 can clearly vary as understood by those of ordinary skill in the art.

The data communication device 7 operates as one administration control for copiers 1 to 5 and transmits a command such as a reading command for reading status data of the copiers 1 to 5 or a writing command for writing control parameters in memories in the copiers 1 to 5. Further, the data communication device 7 transmits an indication that service or other requirements are needed for copiers 1 to 5, such as a repair request or a request of a need for consumption articles such as sheets of paper and toner, to the service terminal 6 through the communication line 8. The data communication device 7 also transmits an alarm message for preventive maintenance for any of copiers 1 to 5 to the service terminal 6 when, for example, for any of copiers 1 to 5 a predetermined number of copiers have been made, a predetermined period of time has elapsed, an output from sensors which sense conditions of processing devices in a copier has reached a predetermined value, etc. If desired, when a predetermined number of copies have been made for any of copiers 1 to 5, a flag in a memory in data communication device 7 is set. Subsequently, when a predetermined set time such as 7:00 p.m. or 1:00 a.m. is reached, a preventative maintenance signal is transmitted from the data communication device 7 to the service terminal 6, when the flag is set.

Electric power can be supplied to the data communication device 7 for 24 hours a day so that data communication device 7 can operate and transmit information even if electric power to the copiers 1 to 5 is cut off. The data communication device 7 and the copiers 1 to 5 to can be connected in a multi-drop form through a serial communication interface RS-485, although any other communication may be used. The data communication can be established by means of a polling operation and a selecting operation by the data communication device 7 of the copiers 1 to 5.

FIG. 2 shows a control unit of the copier 1. Explanations of the control units of the copiers 2 to 5 are omitted since the configurations of the control units of the copiers 2 to 5 are the same as that of the copier 1 of FIG. 2. The control unit of the copier 1 includes a copier controller 31 which includes a central processing unit (CPU) 11, a read only memory (ROM) 12, a random access memory (RAM) 13, a non-volatile RAM 14, an input/output port (I/O port) 15, a serial communication control unit 16, an interface (I/F) 17, and a system bus 18.

The CPU 11, which may be implemented in any desired manner including utilizing a microprocessor, controls the overall activities of the copier controller 31 according to a control program in the ROM 12. The ROM 12 stores the control program and the like for controlling the operation of the CPU 11. The RAM 13 is operable as a work-memory for the CPU 11. The non-volatile RAM 14 stores contents of mode instructions input from an operation panel of copier 1. The non-volatile RAM 14 can be backed-up by a battery. Output devices in the copier 1 such as motors, solenoids, clutches and the like, sensors, switches, and the like, are connected to the I/O port 15. Plural serial communication control units 16 are provided in the copier controller 31 and communicate information with an operation panel, a document feeder, a finisher, and the like.

The interface 17 controls communication between the copier controller 31 and the data communication device 7, and may be implemented in any suitable manner. As a result of utilizing a designated interface 17, a load for communication on the CPU 11 is reduced. The interface 17 can be positioned either internally of or externally to the copier 1 to 5. If the CPU 11 has enough capacity for controlling the communication, it is also possible to design the system such that the CPU 11 controls the communication instead of the interface 17. In the present embodiment, the interface 17 has the following functions.

1) watching a polling operation and a selecting operation from the data communication device 7 to the copier 1;

2) processing responses which indicate that data transmission is a success (success-response) or that data transmission is a failure (failure-response);

3) checking correctness of data between the interface 17 and the data communication device 7 and parity, and requesting retransmission in a case of a transmission error; and

4) header processing of data between the interface 17 and the data communication device 7.

In FIG. 2, the system bus 18 includes an address bus, a control bus and a data bus. The CPU 11, the ROM 12, the RAM 13, the non-volatile RAM 14, the I/O port 15, the serial communication control unit 16 and the interface 17 are connected to each other through the system bus 18.

FIG. 3 is a block diagram showing the interface 17 of FIG. 2. Referring to FIG. 3, the interface 17 includes a CPU 21, a dual port memory 22, registers 23 to 26, an input port 27, a serial communication control unit 28, a local bus 29, and a device code setting switch 30.

The CPU 21 controls the overall activities of the interface 17 and can act as a communication CPU to free the CPU 11 of the copier 1 for image forming operations. The dual port memory 22 can be read from and written to by both of the CPU 11 of FIG. 2 and the CPU 21. Text data is communicated between the interface 17 and the copier controller 31 through the dual port memory 22. The text data is temporally stored in the registers 23 to 26 when the data is communicated between the interface 17 and the copier controller 31.

The device code setting switch 30 sets a unique device code corresponding to each copier. The device code is used to discriminate a target copier during a polling operation and a selecting operation. The serial communication control unit 28 can be connected to the data communication device 7 and the interfaces in the other copiers 2 to 5.

FIG. 4 shows an operation panel of the copiers 1 to 5. Referring to FIG. 4, the operation panel includes a ten-key pad 71 for inputting numbers, a clear/stop key 72 for clearing the input numbers and stopping a copying operation, a start key 73 for starting the copying operation, an enter key 74 for setting an input copying mode, an interrupt key 75 for interrupting the copying operation and for permitting the setting of another copying mode, a mode

clear/preheating key **76** for clearing set copying mode and for setting a preheating mode, a mode check key **77** for indicating the copying mode which is set, and a screen changing key **78** for changing contents of indication in response to an experience level of the operator of the copier. Further, the operation panel includes a reading out key **79** for reading out the copying mode set by an operator and stored in memory, a register key **80** for registering the copying mode to memory, a guidance key **81** for indicating a guidance message on the screen **83**, and a contrast adjusting nob **82** for adjusting the contrast of the screen **83**. The screen **83** includes dot display elements and may be implemented by a liquid crystal display or a fluorescent screen and a matrix touch panel of a transparent sheet in which touch sensors are provided. Alternatively, any other desired type of display may be used.

FIG. **5** shows the screen **83** of the operation panel of FIG. **4** in a typical usage. The screen **83** of FIG. **5** includes a display for inputting an operation command for image formation when a power switch is turned on. A plurality of image forming operation modes, such as a size of paper, image density, magnification and reduction ratio, a duplex mode, a binding margin setting mode, a sorting mode, and the like, are set by pressing keys. The color of pressed keys may be reversed as compared to keys which are not pressed.

FIG. **6** is a block diagram showing the data communication device **7** of FIG. **1**. The data communication device **7** includes a controller **41**, an auto dialing unit **42**, and a circuit control unit **43**. The controller **41** controls communication between the copiers **1** to **5** and the data communication device **7**, and the communication between the data communication device **7** and the service terminal **6** through the communication line **8**. If the service terminal **6** is remotely located from the copiers **1** to **5** and data communication device **7**, the auto dialing unit **42** can call the service terminal **6** in response to reports from the copiers **1** to **5**. The circuit control unit **43** switches the circuit between the data communication device **7** and a telephone **44**. If the service terminal **6** is not remotely located, the auto dialing unit **42** and telephone need not be provided or operated.

The controller **41** can include a ROM, a CPU, a RAM, a non-volatile RAM, a serial communication unit, an I/O port, a timer for counting real time, etc. Such a non-volatile RAM can store data communicated between the service terminal **6** and each copier **1** to **5**, device codes for identifying one copier among the copiers **1** to **5**, a telephone number of the service terminal **6**, a number of times of recalling the service terminal **6**, an interval of recalling and date and time for transmitting total counter value of copiers, etc.

The image forming apparatus administration system has at least the following functions:

1) Communication control from the service terminal **6** or the data communication device **7** to the copiers **1** to **5**;

2) Communication control from the copiers **1** to **5** to the service terminal **6** or the data communication device **7**; and

3) Control the data communication device **7** itself.

Each function is now explained in detail.

1) Communication Control From The Service Terminal **6** Or The Data Communication Device **7** To The Copiers **1** to **5**.

a) A number of copies of a selected copier, a number of copies of each paper feeder of a selected copier, a number of copies of each paper size, a number of paper jams of a selected copier, a number of paper jams of each paper size, a number of jams of each of paper transport positions, etc. are read from the copiers **1** to **5** by the service terminal **6** through the data control device **7**.

b) The above mentioned each number is initialized.

c) Control values for controlling operations of processing devices for image formation in the copier such as voltages, electric current, resistors and control timing are written in respective memories in each copier. Further, the control values stored in the memories are read in response to a command from the service terminal **6**.

d) Each copier transmits a success-response or a failure-response to the service terminal **6** through the data communication device **7**, or the copier transmits the success-response or the failure-response to the data communication device **7** in response to received data.

One of copiers **1** to **5** is selected by a selecting operation and transmits data or information to the data communication device **7** according to a) to d) above. The selecting operation is the operation by which the data communication device **7** selects one copier among the copiers **1** to **5** connected to the data communication device **7**.

FIG. **7** shows the selecting operation. Each copier **1** to **5** has a unique device code respectively. The data communication device **7** transmits a selection identified code indicating a selecting operation and a device code for selecting a copier of the copiers **1** to **5** through, e.g., a RS-485 serial interface. Each copier **1** to **5** compares its stored unique device code with the device code transmitted from the data communication device **7**. The copier with the unique device code in agreement with the transmitted device code from the data communication device **7** executes the following operation as shown in FIG. **7**.

Referring to FIG. **7**, if the selected copier has stored data for transmitting to the data communication device **7**, the selected copier transmits a busy response to the data communication device **7** (in step **1**). In response to the busy response, the data communication device **7** stops the selecting operation and initiates a polling operation (in step **7**). If the selected copier has not stored data for transmitting to the data communication device **7** (NO in step **1**), the selected copier judges whether it can communicate with the data communication device **7** (in step **2**). If the selected copier can communicate with the data communication device **7** (YES in step **2**), the selected copier transmits a success-response to the data communication device **7** and then communication of text data between the data communication device **7** and the selected copier is established (in step **3**), and is executed until completed (in step **4**). If the selected copier can not communicate with the data communication device **7** (NO in step **2**), the selected copier transmits a failure-response to the data communication device **7** (in step **5**) and the communication between the selected copier and the data communication device **7** is finished. If the data communication device **7** does not receive any response from the selected copier, the data communication device **7** terminates the selecting operation after a predetermined period of time has elapsed (in step **6**).

2) Communication Control From The copiers **1** to **5** To the Service Terminal **6** or The Data Communication Device **7**

a) When a copier breaks down and an image forming operation can not be performed, information indicating that a copier is broken down is transmitted to the service terminal **6** through the data communication device **7** and the data communication line **8** immediately. This data communication is referred to as a SC CALL.

b) When predetermined keys, e.g., the ten-key pad **71**, the clear/stop key **72**, and the mode clear/preheating key **76** of FIG. **5**, etc., are pressed in a predetermined manner

by an operator, the screen 83 of a copier changes its indication from an indication for inputting an operation command for image formation (an image forming mode) to an indication for inputting a request command for transmitting request data from the copier to the service terminal 6 through the data communication device 7 (a request mode). In the request mode, when an operator touches, e.g., the CALL key on the screen 83, request data is transmitted from the copier to the service terminal 6 through the data transmission device 7 and the communication line 8. This data communication is referred to as a Request Call.

c) When predetermined keys, which are different from the predetermined keys of the Request Call, are pressed in a predetermined manner by a customer engineer, the screen 83 changes its indication from an indication for inputting an operation command for image formation (the image forming mode) to an indication for inputting a command by the customer engineer for transmitting data from the copier to the service terminal 6 through the data communication device 7. The customer engineer inputs the command when the customer engineer starts a repair and finishes the repairs. Therefore, the repair starting time and the repair finishing time are understood by an operator at the service terminal 6. This data communication is referred to as a CE (Customer Engineer) call.

d) The copier 1 to 5 transmits an alarm message for preventive maintenance to the service terminal 6 through the data communication device 7 and the communication line 8 at a specified time if, e.g., a predetermined number of copies are made, a predetermined period of time has elapsed, an output from sensors which sense conditions of processing devices in the copier reach a predetermined value, etc. This data communication is referred to as an Alarm Call.

The data communication device 7 polls the selected copier 1 to 5, and if the polled copier has data to be transmitted to the service terminal 6, the copier transmits the data to the service terminal 6 through the data communication device 7 and the data communication line 8 according to a) to d). The polling operation polls the copiers 1 to 5 in turn and checks whether any of the copier has a transmission request.

FIG. 8 shows the polling operation. The data communication device 7 transmits a polling identified code indicating the polling operation and the device code for selecting a copier through, e.g., a RS-485 serial interface. Each copier 1 to 5 compares its unique device code with the device code transmitted from the data communication device 7. The copier with the unique code in agreement with the transmitted device code from the data communication device 7 executes the following operation as shown in FIG. 8.

If the polled copier has stored data for transmission to the data communication device 7, the polled copier transmits text data to the data communication device 7 (in steps 11 and 12). If the polled copier does not have any data for transmission to the data communication device 7 or the data transmission of the text data has been finished (YES in step 11), the communication between the polled copier and the data communication device 7 is terminated by transmitting a specific code indicating data transmission termination to the data communication device 7. When the data communication device 7 receives this termination specific code, the data communication device 7 polls the next copier (in step 14).

If the copier with the device code in agreement with the transmitted device code can not communicate with the data communication device 7, e.g., if electric power is not supplied to the copier or the like, the data communication device 7 finishes its polling operation after a predetermined period of time has elapsed (in step 13). The data communication device 7 then continues to poll the copiers 1 to 5 until the selecting operation starts.

3) Control The Data Communication Device 7 Itself

An operation of controlling the data communication device 7 itself includes an operation for reading out total counter values of each copier 1 to 5 from memories in the data communication device 7. The total counter value of each copier 1 to 5 is transmitted to the data communication device 7 in response to a selecting operation operated by the data communication device 7, e.g., once a day at a predetermined time. If electric power is not supplied to the copier at the predetermined time, the total counter value is transmitted when a power switch of the copier is turned on.

The data transmission device 7 can include two memories, a memory A and a memory B. Total counter values that are transmitted from the copiers in response to the selecting operation can be stored in memory A. The total counter values stored in memory A are accumulated every day. The accumulated total counter values in the memory A can then be transferred to memory B periodically, e.g. once a month. The transferring day and time can be transmitted from the service terminal 6 to the data communication device 7 and then the transmitted day and time can be stored in a non-volatile RAM in the data transmission device 7. The accumulated total counter values can then be transmitted from the memory B to the service terminal 6 through the data communication line 8.

FIG. 9 shows one form that the text data communicated between the service terminal 6 and the data communication device 7 can take. The test data can take the form of ASCII, although clearly other representations, such as binary, can be used. A first block can be designated as 01 and the number can increase one by one. If the number reaches 99, the number is set as 00. Referring to FIG. 9, the following codes and data are shown. An ID is a code which includes a model number and a manufacturing number of each copier to specify a copier among the copiers 1 to 5. A discrimination code is a code which includes a processing code indicating a type of the processing, a source of data transmission and a source of data receipt. The processing code can be determined by the following Table 1.

TABLE 1

Code	Names of Processing	Contents of Processing
30	SC CALL	When a copier breaks down, data is transmitted from the copier to the service terminal 6.
31	Manual CALL	Request data is transmitted from the copier to the service terminal 6 in response to operation of keys on the operation panel 83 of the copier.
32	Alarm CALL	If the copier is in an alarm condition, the copier transmits data to the service terminal 6.
02	Data Reading	Data in memories in the copier is read in response to a command from the service terminal 6 or the data communication device 7.
04	Data Writing	Data which is transmitted from the service terminal 6 is written in the memories in the copier.

Information records can include information code, digit number of data and data portion as shown in Table 2.

TABLE 2

Code	Contents of Code
Information Code	Code which indicates the kind of data.
Digit Number of Data	Length of data portion. If there is no data, the digit number is 00.
Data Portion	Data which is indicated by the information code.

Semicolons (;) for separating data can be inserted between the ID code and the discrimination code, the discrimination code and the information record, and the information record and the next information record, respectively.

FIG. **10** shows one form that the text data communicated between the data communication device **7** and the interface **17** in each copier **1** to **5** can take. Referring to FIG. **10**, the device code is a code which includes numbers 1 to 5 assigned to each copier. The device code is set by the device code setting switch **30** of FIG. **3**. The set device code is connected to the ID code by the data communication device **7**. The processing code is a code which indicates a name of the processing and can be identical with the processing code of FIG. **9**.

FIG. **11** shows one form that the text data communicated between the interface **17** and the copier controller **31** of FIG. **3** can take. The text data of FIG. **11** includes the processing code and the information record.

As noted above, one drawback in background systems is that if a copier is sending a request command to a service terminal, the copier will not be able to operate in an image forming mode until a response to the request command is returned to the copier from the service terminal. In such instances, in such background devices a display of the copier will indicate operation in their request mode, and the copier will not be operable in an image forming mode until the request mode has ended.

One feature of the present invention is to allow operation of an image forming apparatus in an image forming mode while still awaiting completion of a request mode. In this operation of the present invention, a display of the image forming apparatus can change from a display for an image forming mode to a display for a request mode and back to the display for the image forming mode before the request mode is completed, as discussed in further detail below with reference to FIG. **12** and FIGS. **13–16**; FIGS. **13–16** show various display conditions of screen **83** of a copier **1** to **5**.

FIG. **12** shows a process for indicating a message on the screen **83** as shown in FIG. **4** of a copier **1** to **5**. This process can be controlled by the copier controller **31** which includes the CPU **11**, the ROM **12**, the RAM **13**, the non-volatile RAM **14**, the I/O port **15**, and the serial communication unit **16**. Referring to FIG. **12**, after a power source switch of a copier **1** to **5** is turned on, the screen **83** indicates a message for inputting an operation command for image formation as shown in FIG. **6** (in step **21**). The copier controller **31** judges whether predetermined keys for changing an indication of the screen **31** are pressed or not (in step **22**). If the predetermined keys on the operation panel are pressed in a predetermined manner (for example if at first the mode clear/preheating key **76** is pressed, then the 0 key of the ten-key is pressed two times in succession, and finally the clear/stop key **72** is pressed), the screen **83** changes its indication from an indication for inputting an operation command for image formation (an image forming mode display) to an indication for inputting a request command for transmitting a request from the copier to the service terminal **6** (a request mode display) as shown in FIG. **13** (in step **23**).

The copier controller **31** then judges whether a predetermined key, e.g. the CLOSE key of FIG. **13**, is pressed or not (in step **24**). If the CLOSE key is pressed (YES in step **24**), the screen **83** changes its indication to an indication for inputting an operation command for image formation (by returning to step **21**). If the CLOSE key is not pressed (NO in step **24**), the copier controller **31** judges whether a further predetermined key, e.g. the CALL key of FIG. **13**, is pressed or not (in step **25**). If the CALL key is not pressed (NO in step **25**), the screen **83** does not change its indication (by returning to step **23**).

If the CALL key of FIG. **13** is pressed in step **25** (YES in step **25**), a request is transmitted from the copier to the service terminal **6** through the data communication device **7** and the data communication line **8** when the copier is polled by the data communication device **7** as shown in FIG. **8** (in step **26**). Then, the screen **83** indicates a message as shown in FIG. **14** (in step **27**). The data which is transmitted to the service terminal **6** includes text data as shown in FIG. **9**. When the service terminal **6** receives the transmitted data, the service terminal **6** transmits a success-response to the data communication device **7**. The data communication device **7** transmits the success-response to the copier which is selected by the selecting operation of FIG. **7**.

In FIG. **12**, the copier controller **31** then judges whether the, e.g., CLOSE key of FIG. **14** is pressed or not (in step **28**). If the CLOSE key is not pressed (NO in step **28**), the copier controller **31** checks the transmission conditions (in steps **29** and **30**). If the copier controller **31** receives a success-response in step **30**, the copier controller **31** indicates a message as shown in FIG. **15** (in step **31**). Then, the copier controller **31** judges whether the, e.g., CLOSE key of FIG. **15** is pressed or not (in step **32**). If the CLOSE key is pressed (YES in step **28**), the screen **83** changes its indication to the indication for inputting the operation command for the image formation (in step **35**).

If the copier controller **31** judges that the transmission is a failure (in step **29**), the screen **83** indicates a message as shown in FIG. **16** (in step **33**). The copier controller **31** then judges whether the, e.g., CLOSE key of FIG. **16** is pressed or not (in step **34**). If the CLOSE key is pressed (YES in step **34**), the screen **83** changes its indication to an indication for inputting the operation command for the image formation (by returning to step **21**).

In the present embodiment, if the copier controller **31** receives the failure-response from the service terminal **6** through the data communication device **7**, the copier controller **31** judges whether the transmission is a failure. Further, if the requirement can not be transmitted to the service terminal **6**, even if the data communication device **7** calls in a predetermined number of times at a predetermined intervals to the service terminal **6**, the copier controller judges that the transmission is a failure. In this case, the data communication device **7** transmits the failure-response to the copier which transmitted the request data.

If the CLOSE key of FIG. **14** is pressed after the CALL key of FIG. **13** is pressed and before the screen **83** indicates the message of FIG. **15** or **16**, the screen **83** changes its indication to an indication for inputting the operating command for the image formation as shown in FIG. **5** (in step **35**). If, e.g., the keys for setting the image forming mode and the start key **73** are pressed, the copier controller **31** controls the copier such that the copier starts the image forming operation. Even if the screen **83** changes its indication and the copier starts the image forming operation, the data transmission of the request data from the copier to the service terminal **6** through the data communication device **7** and the communication line **8** has been continued.

The copier controller **31** judges whether the keys are pressed in the predetermined manner as explained at steps **22** and **23** or not (in step **36**). If the keys are pressed (YES in step **36**), the screen **83** changes its indication to the indication of FIG. **14**, **15** or **16** corresponding to the condition of data transmission. Namely, if the copier controller **31** does not receive the response from the data communication device **7**, the message of FIG. **14** is indicated on the screen **83** (in step **26**). If the copier controller **31** receives the success-response, the message of FIG. **15** is indicated on the screen **83** (in step **31**). If the copier controller **31** receives the failure-response, the message of FIG. **16** is indicated on the screen **83** (in step **33**).

According to the present embodiment, if the operator operates keys on the operation panel of each copier **1** to **5** in the predetermined manner, the screen **83** changes its indication from the image forming mode to the request mode. If the operator presses the CALL key, the requirement is transmitted to the service terminal **6** through the data communication device **7** and the communication line **8**, and the screen **83** indicates a message "Now Calling Service Center. Please wait a minute" and the CLOSE key. If the operator presses the CLOSE key, the screen **83** changes its indication from the request mode to the image forming mode. In the image forming mode, if the keys for setting the image forming mode and the start key **73** are pressed, the copier controller **31** controls the copier such that the copier starts the image forming operation. Even if the screen **83** changes its indication and the copier starts the image forming operation, the data transmission of the request data from the copier to the service terminal **6** through the data communication device **7** and the communication line **8** is continued.

When the copier controller **31** receives the success response or the failure-response from the data communication device **7**, messages for indicating the result of the data transmission are indicated on the screen **83**. If the operator presses the CLOSE key on the screen **83**, the screen **83** changes its indication from the request mode to the image forming mode.

If the copier controller **31** receives the response of the result of the data communication when the copier is in the image forming mode, the messages for indicating the result of the data transmission are indicated on the screen **83** when the screen **83** changes its indication from the image forming mode to the request mode by operating the keys of the operation panel in the predetermined manner. Therefore, the operator can see the result of the data transmission.

In the present embodiment, the indication of the screen **83** can thus be changed from the request mode to the image forming mode even if the request data transmission has not yet been changed. It is also possible that when the data transmission is made under the CE call mode or alarm call mode, the indication of the screen **83** can be changed from the CE call mode or the alarm call mode to the image forming mode even if the request mode data transmission has not yet been changed. Under the requirement mode and the CE call mode, the indication of the screen **83** can be changed from the image forming mode to the request mode or the CE call mode by operating the keys in a predetermined manner. On the other hand, under the alarm call mode, the indication of the screen **83** is automatically changed from the image forming mode to the alarm call mode under control of the copier controller **31**, when the selected copier **1** to **5** is in a data transmission condition. In the indication of the CE call mode and the alarm call mode, a message for indication of the data transmission condition and also the CLOSE key for changing the indication of the screen **83** from the alarm call mode to the image forming mode are indicated on the screen **83**. If the operator or the customer engineer presses the CLOSE key, the indication of the screen **83** is changed from the CE call mode or the alarm call mode to the image forming mode for forming an image. The operator and the customer engineer can see the transmission conditions by operating the keys in a predetermined manner.

In the present embodiment, when the plural keys are pressed in the predetermined manner, the screen **83** changes its indication from the image forming mode to the request mode. Therefore, it is not necessary to provide an exclusive key. However, it is also possible to provide an exclusive key for changing the indication from the request mode to the image forming mode.

Further, it is also possible to connect other apparatuses such as a printer or a facsimile machine instead of or together with the copiers **1** to **5** to this administration system.

Obviously, numerous additional modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described herein.

The present application is based in Japanese Priority Document 9-52935, the contents of which are incorporated herein by reference.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A method of operating an image forming apparatus, comprising the steps of:

generating an image while a display of the image forming apparatus is in an image forming mode;

changing the display to a communication mode;

communicating information between the image forming apparatus and a service terminal connected to the image forming apparatus, the information including the image forming apparatus initiating a call to the service terminal;

changing the display from the communication mode to the image forming mode before the step of communicating is completed.

2. The method according to claim **1**, wherein the service terminal is a central station remotely located from the image forming apparatus.

3. The method according to claim **1**, wherein the service terminal is within a local region shared with the image forming apparatus.

4. The method according to claim **1**, wherein the image forming apparatus and the service terminal are connected by a LAN.

5. The method according to claim **1**, further comprising the step of:

controlling communications between the image forming apparatus and the service terminal by a communications CPU separate from a main CPU of the image forming apparatus in order to free the main CPU for image forming operations.

6. The method according to claim **1**, wherein the communications CPU is external to the image forming apparatus.

7. The method according to claim **1**, wherein the communications CPU is internal to the image forming apparatus.

8. The method according to claim **5**, wherein the step of controlling communications continues to control said step of communicating information after the step of changing the display from the communication mode to the image forming mode.

9. The method according to claim 8, further comprising the step of:

changing the display to the communication mode after the step of changing to the image forming mode, and displaying a status of said step of communicating information.

10. An administration system for an image forming apparatus, comprising:

a display on the image forming apparatus displaying that the image forming apparatus is in an image forming mode and a communication mode;

a communicating network communicating information between the image forming apparatus and a service terminal connected to the image forming apparatus, the information including the image forming apparatus initiating a call to the service terminal;

a controller changing the display of the image forming apparatus from the communication mode to the image forming apparatus and service terminal is completed.

11. The system according to claim 10, wherein the service terminal is a central station remotely located from the image forming apparatus.

12. The system according to claim 10, wherein the service terminal is within a local region shared with the image forming apparatus.

13. The system according to claim 10, wherein the image forming apparatus and the service terminal are connected by a LAN.

14. The system according to claim 10, further comprising:

a communications CPU controlling communications between the image forming apparatus and the service terminal separate from a main CPU of the image forming apparatus in order to free the main CPU for image forming operations.

15. The system according to claim 10, wherein the communications CPU is external to the image forming apparatus.

16. The system according to claim 10, wherein the communications CPU is internal to the image forming apparatus.

17. The system according to claim 14, wherein the information is communicated after changing the display from the communication mode to the image forming mode.

18. The system according to claim 17, wherein the display changes to the communication mode after changing to the image forming mode, and further displays a status of said communicating information.

19. An administration system for an image forming apparatus, comprising:

display means for displaying that the image forming apparatus is in an image forming mode and a communication mode;

a communicating means for communicating information between the image forming apparatus and a service terminal connected to the image forming apparatus, the information including the image forming apparatus initiating a call to the service terminal;

control means for changing the display means from the communication mode to the image forming mode before communication of the information between the image forming apparatus and service terminal is completed.

20. The system according to claim 19, wherein the service terminal is a central station remotely located from the image forming apparatus.

21. The system according to claim 19, wherein the service terminal is within a local region shared with the image forming apparatus.

22. The system according to claim 19, wherein the image forming apparatus and the service terminal are connected by a LAN.

23. The system according to claim 19, further comprising:

a communications control means for controlling communications between the image forming apparatus and the service terminal separate from a main CPU of the image forming apparatus in order to free the main CPU for image forming operations.

24. The system according to claim 19, wherein the communications CPU is external to the image forming apparatus.

25. The system according to claim 19, wherein the communications CPU is internal to the image forming apparatus.

26. The system according to claim 23, wherein the information is communicated after changing the display means from the communication mode to the image forming mode.

27. The system according to claim 26, wherein the display means changes to the communication mode after changing to the image forming mode, and further displays a status of said communicating information.

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